



THE UNIVERSITY of EDINBURGH  
Global Academy of  
Agriculture and Food Systems

**DDI** Data-Driven  
Innovation  
*Part of the Edinburgh & South East Scotland City Region Deal*

# Proteins



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# Myths

## ...about protein needs and qualities

- “Protein is only found in meat, eggs, and dairy”
- “There is no such thing as too much protein”
- “Vegan diets can’t meet protein needs”
- “Eating protein can build muscle, even without resistance exercise”



# Proteins build body structures and have other important functions

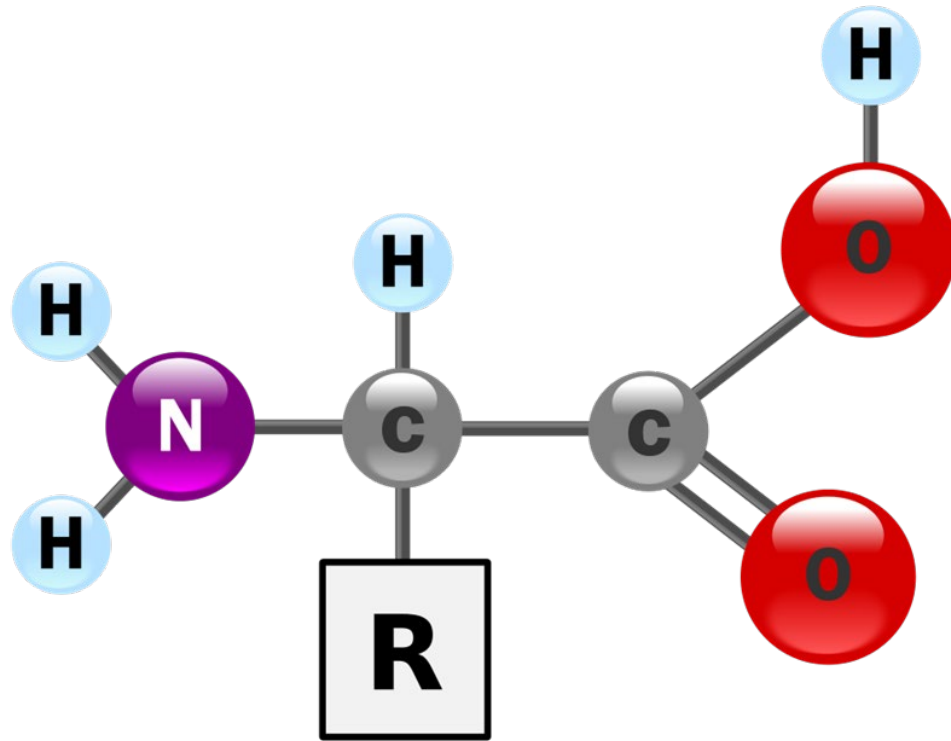
- Provide energy
- Transport substances
- Component of
  - Neurotransmitters
  - Enzymes
  - Hormones
- Immune system functioning
- Maintain acid-base balance
- Maintain fluid balance



Photo by [Sam Moghadam Khamseh](#) on [Unsplash](#)



# Proteins are found in all kinds of foods



- Proteins are made up of amino acids
- Proteins are made of carbon, hydrogen, oxygen, and nitrogen
- There are many kinds of proteins, which vary depending on the “side group”

Amino acid ball. By GYassineMrabetTalk, Public domain, via Wikimedia Commons



# Proteins are found in all kinds of foods

**TABLE 10-1** Dispensable, Indispensable, and Conditionally Indispensable Amino Acids in the Human Diet

Indispensable	Dispensable	Conditionally Indispensable <sup>a</sup>	Precursor(s) of Conditionally Indispensable
Histidine <sup>b</sup>	Alanine	Arginine	Glutamine/glutamate, aspartate
Isoleucine	Aspartic Acid	Cysteine	Methionine, serine
Leucine	Asparagine	Glutamine	Glutamic acid/ammonia
Lysine	Glutamic Acid	Glycine	Serine, choline
Methionine	Serine	Proline	Glutamate
Phenylalanine		Tyrosine	Phenylalanine
Threonine			
Tryptophan			
Valine			

<sup>a</sup>Conditionally indispensable is defined as requiring a dietary source when endogenous

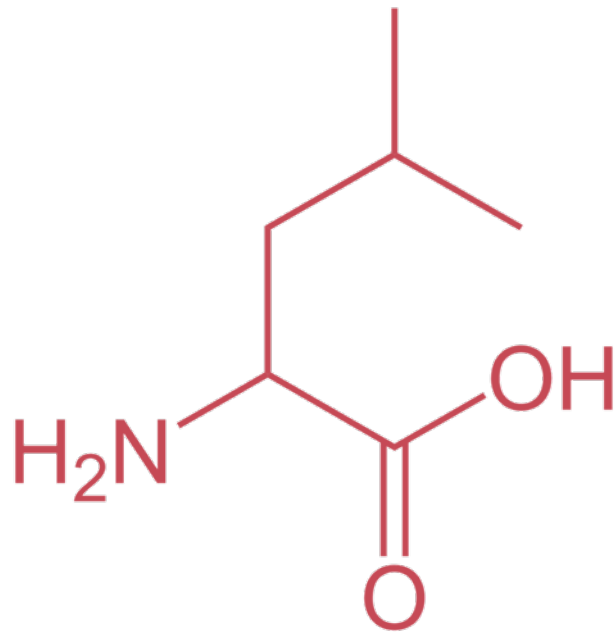
**9 indispensable amino acids in the diet**

ispensable amino deposition and

- About 20 amino acids make the proteins found in the human body
- People need to consume 9 amino acids to support their bodies
- The other amino acids can be made by the body.



# Foods that are “complete proteins” have all 9 indispensable amino acids



Leucine. Sten André, Public domain, via Wikimedia Commons

- Animal sourced foods are complete proteins
- Soy is a complete protein
- Other plant foods need to be combined in meals and snacks to make complete proteins
- You can get enough complete protein by combining plant foods and/or enjoying animal sourced foods.



# Different proteins have different qualities

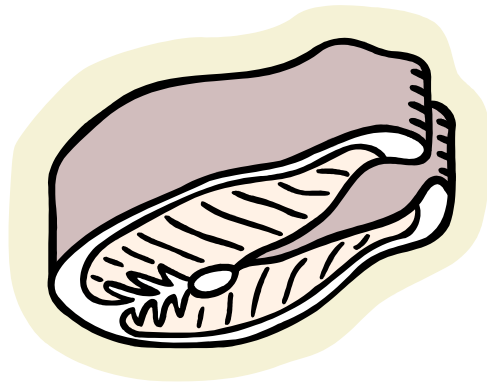
- An incomplete protein is missing one or more of the 9 indispensable amino acids.
- Digestibility of the protein matters as well.
- There are many ways to measure protein quality.

To make a complete protein:

**Legumes + Nuts OR Nuts + Vegetables OR Vegetables + Grains OR Grains + Legumes**

**Complete proteins** (mostly animal sourced):

- Meat
- Fish
- Eggs
- Poultry
- Milk
- Cheese
- Yoghurt
- Soybeans



**Incomplete proteins** (mostly non-animal sourced):

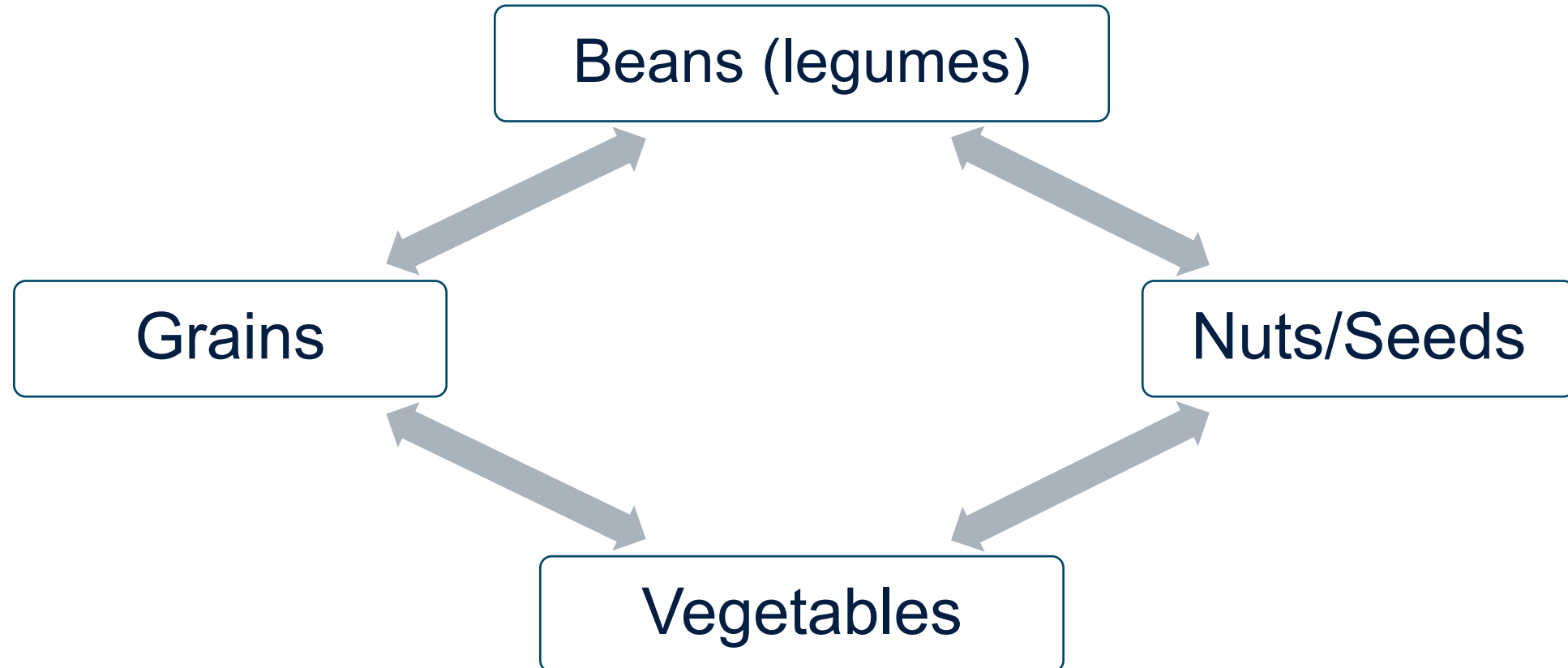
- Plants
- Legumes
- Grains
- Seeds
- Nuts
- Vegetables

© Wadsworth - Thomson Learning

	Ile	Lys	Met	Trp
Legumes	Orange	Orange	White	White
Grains	White	White	Orange	Orange
Together	Orange	Orange	Orange	Orange



# Complementary plant proteins





# How much protein do most people need?

- Most people need about 0.8 grams of protein/kg of body weight
- About 8-10% of kcals, kJ
- Increased by 10-15 grams per day for pregnancy
- Endurance athletes **may** need up to 1.5-2g/kg of body weight
- Most people eat more than the recommended amount of protein
- High protein diets
  - Burden on kidney
  - Increase calcium loss
  - Low in fiber, vitamins (folate), minerals (magnesium), phytochemicals
  - High in saturated fat and cholesterol
  - Increased risk of heart disease, cancer



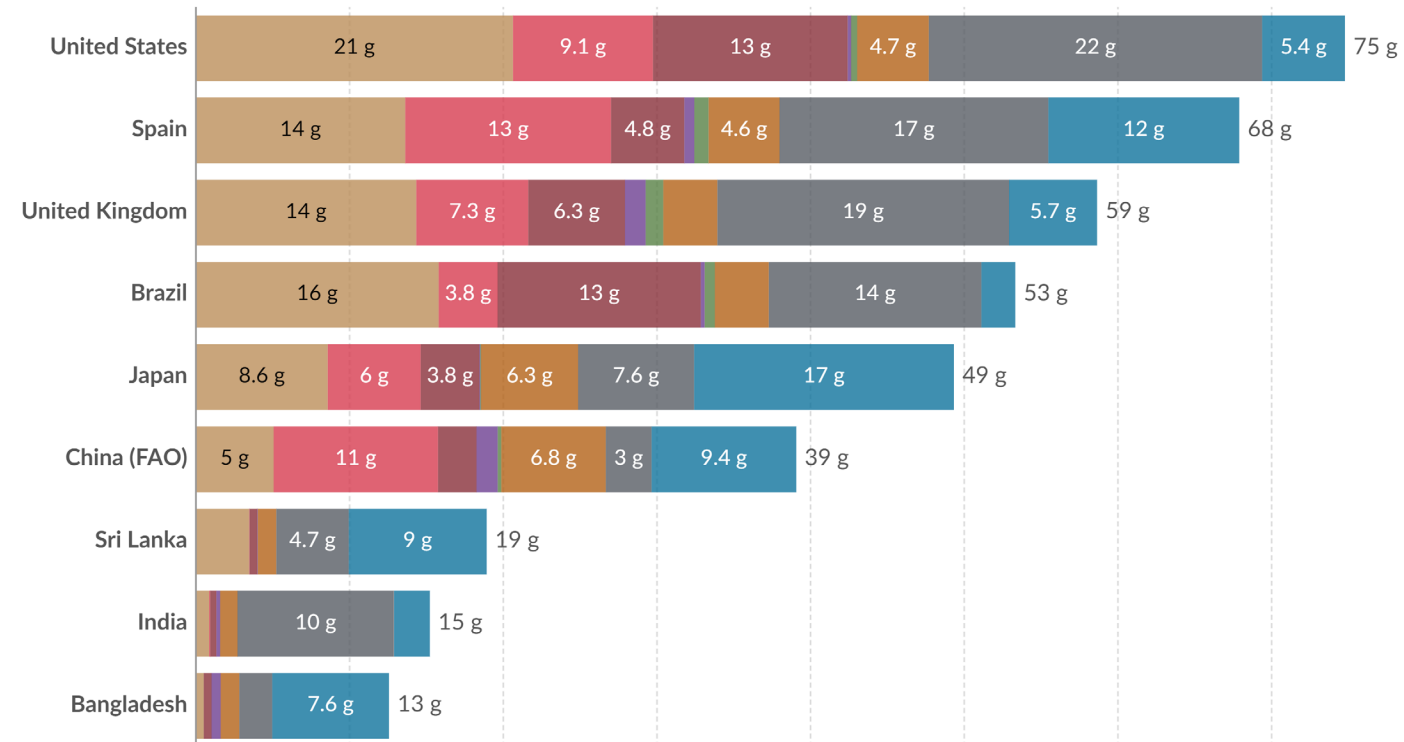
# Protein intakes from animal sourced foods vary around the world

## Animal protein consumption, 2020

Our World  
in Data

This is measured as the average daily supply per person.

■ Poultry 
 ■ Pork 
 ■ Beef 
 ■ Lamb and goat 
 ■ Other meat 
 ■ Eggs 
 ■ Dairy 
 ■ Fish and seafood



Data source: Food and Agriculture Organization of the United Nations

[OurWorldInData.org/diet-compositions](https://OurWorldInData.org/diet-compositions) | CC BY

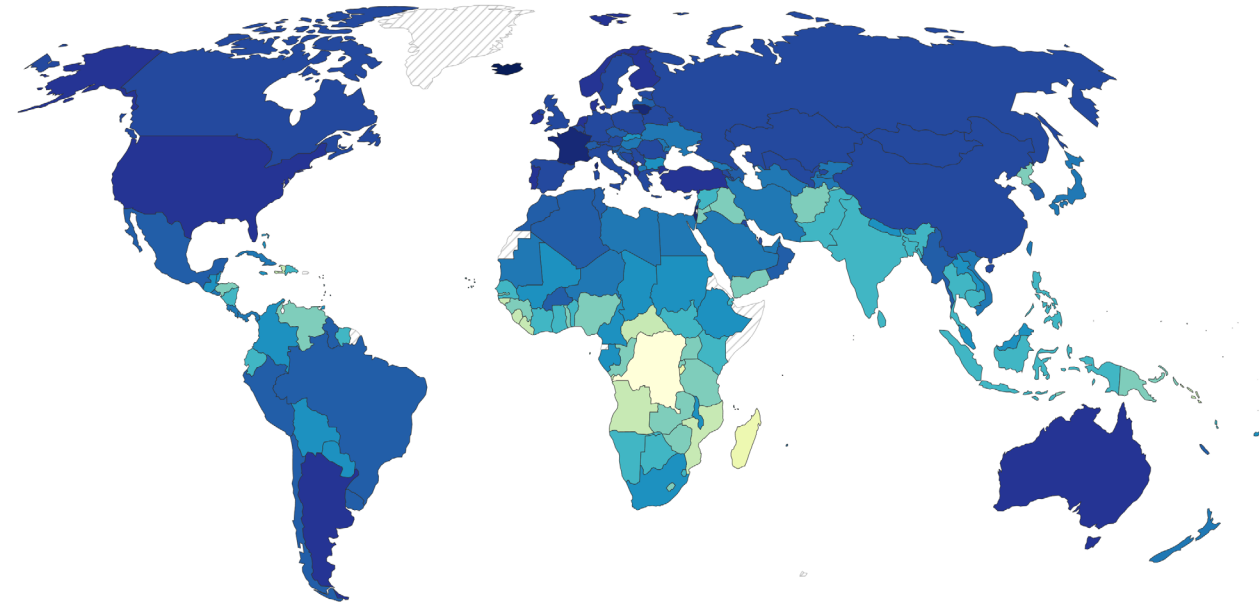


# There is enough supply of protein in most countries

## Daily per capita protein supply, 2020

Average daily per capita protein supply, measured in grams of total protein per day.

Our World  
in Data



Data source: Food and Agriculture Organization of the United Nations

[OurWorldInData.org/food-supply](https://OurWorldInData.org/food-supply) | CC BY

Note: Data measures the availability delivered to households but does not necessarily indicate the quantity of protein actually consumed (food may be wasted at the consumer level).



# Data and resources

- [FAOSTAT Food Balance Sheets](#)
- [Protein in diet](#) – MedlinePlus
- [Protein](#) – British Nutrition Foundation
- [Vary your protein routine](#) – USDA



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# Thank you

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