



Importance of Proteins and Health Benefits of Plant Proteins

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**ACCEPTABLE MACRONUTRIENT DISTRIBUTION
RANGE (AMDR) BY AGE AND PHYSIOLOGICAL
GROUPS AS PERCENT OF ENERGY (%E)**

<u>Age group</u> Nutrients	1-2 years	3-18 years	Adults	Pregnant and lactating women
Protein (PE ratio)*	5-15	5-15	5-15	5-15
Total Fat	30-40	25-35	15-35	20-35
n-6 PUFA[#]	4-10	4-10	4-10	4-10
n-3-PUFA	0.5-1	0.5-1	0.5-1	0.5-1
Carbohydrate	40-60	45-65	45-65	45-65

*Depends on protein quality and total energy intake

[#] n-6 to n-3 ratio should be between 5-10:1

Note: For good health, adults should consume minimum of 100 to 130g of carbohydrates and atleast 20g fats (food sources)

RDA- 0.8 G/Kg B wt

ICMR RDA 2020

Animal Sources of Protein

- Milk, Yoghurt / Curd, Cheese
- Eggs
- Poultry
- Beef (Red)
- Goat and Lamb(Red)
- Pork(Red)
- Fish and other sea food



Plant sources of protein

Whole grains

Legumes

Lentils / dhals

Seeds

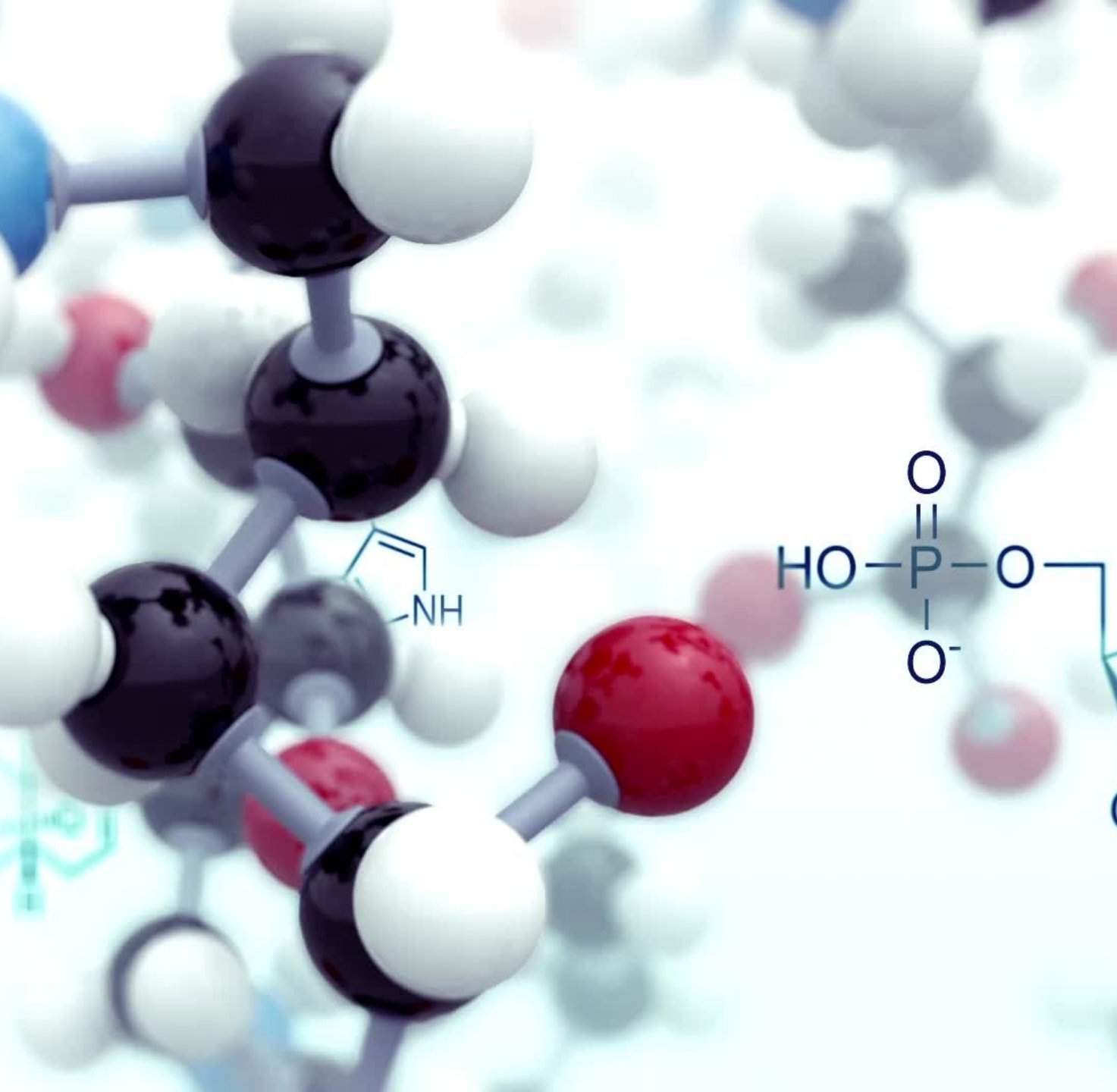
Nuts

Vegetables
and other
plant sources

Neither Plant nor Animal

- Algae – Red, Brown and Green
- Micro and Macro
- Macro- Seaweed
- Protein content- 5 to 47% (in Red varieties)
- Source of all amino acids – As good as egg white





All Proteins
are not equal
in quality

Protein Efficiency Ratio

- $\text{Weight gain of weanling rat} / \text{Weight of protein consumed}$
- Animal protein – 3.1 to 3.7
- Plant protein – 1.2 to 2.4
- $\text{PER} = \text{PDCAAS} \times 2.5$ (Health Canada)
- Reason: Incomplete EAA composition
- Lower digestibility and bioavailability of AA

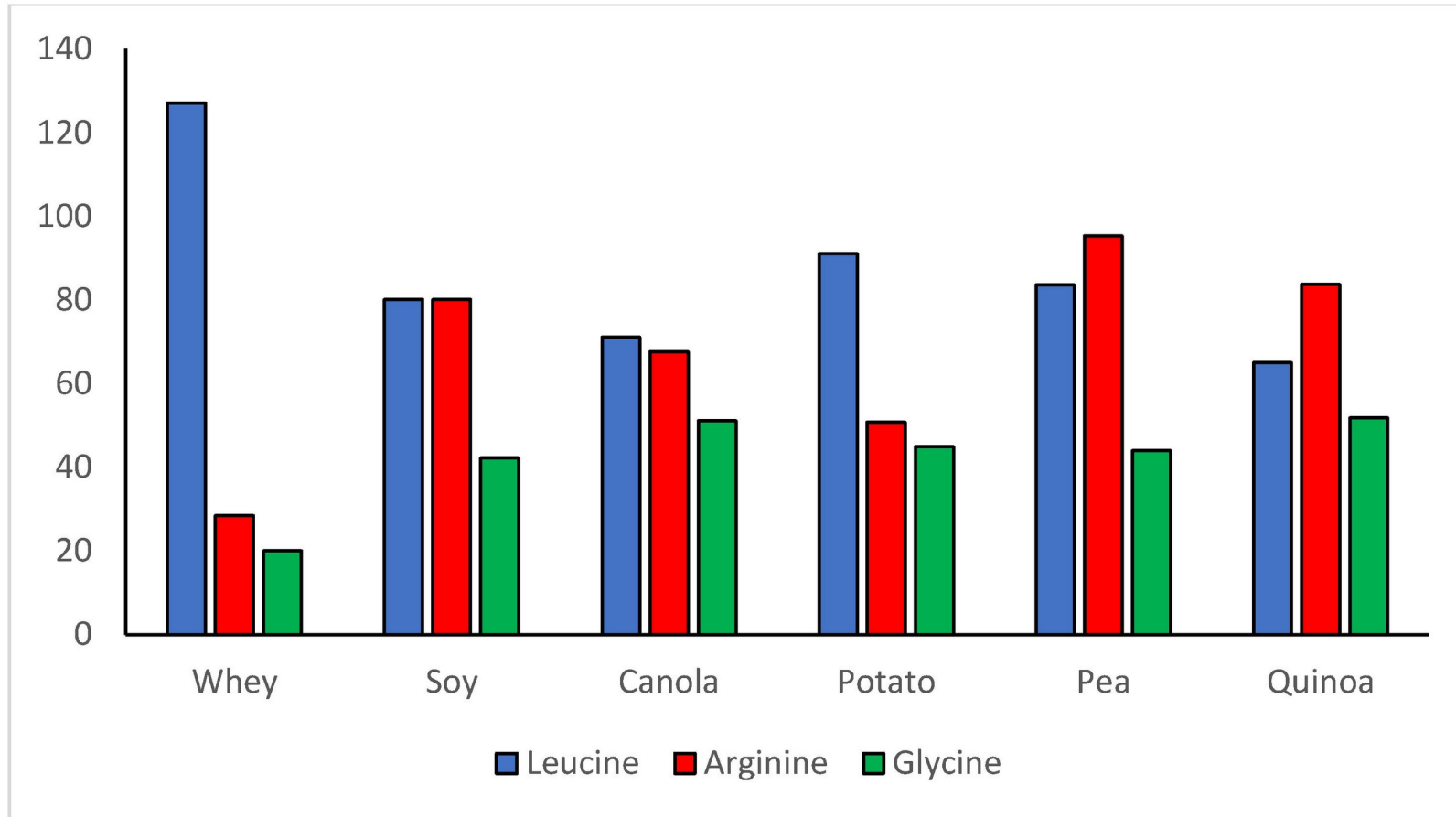
Indispensable	Dispensable	Conditionally Indispensable
Histidine	Alanine	Arginine
Isoleucine	Aspartic acid	Cysteine
Leucine	Asparagine	Glutamine
Lysine	Glutamic acid	Glycine
Methionine	Serine	Proline
Phenylalanine		Tyrosine
Threonine		
Tryptophan		
Valine		

*INDISPENSABLE,
DISPENSABLE, AND
CONDITIONALLY
INDISPENSABLE AMINO
ACIDS IN THE HUMAN DIET.
ADAPTED FROM .*

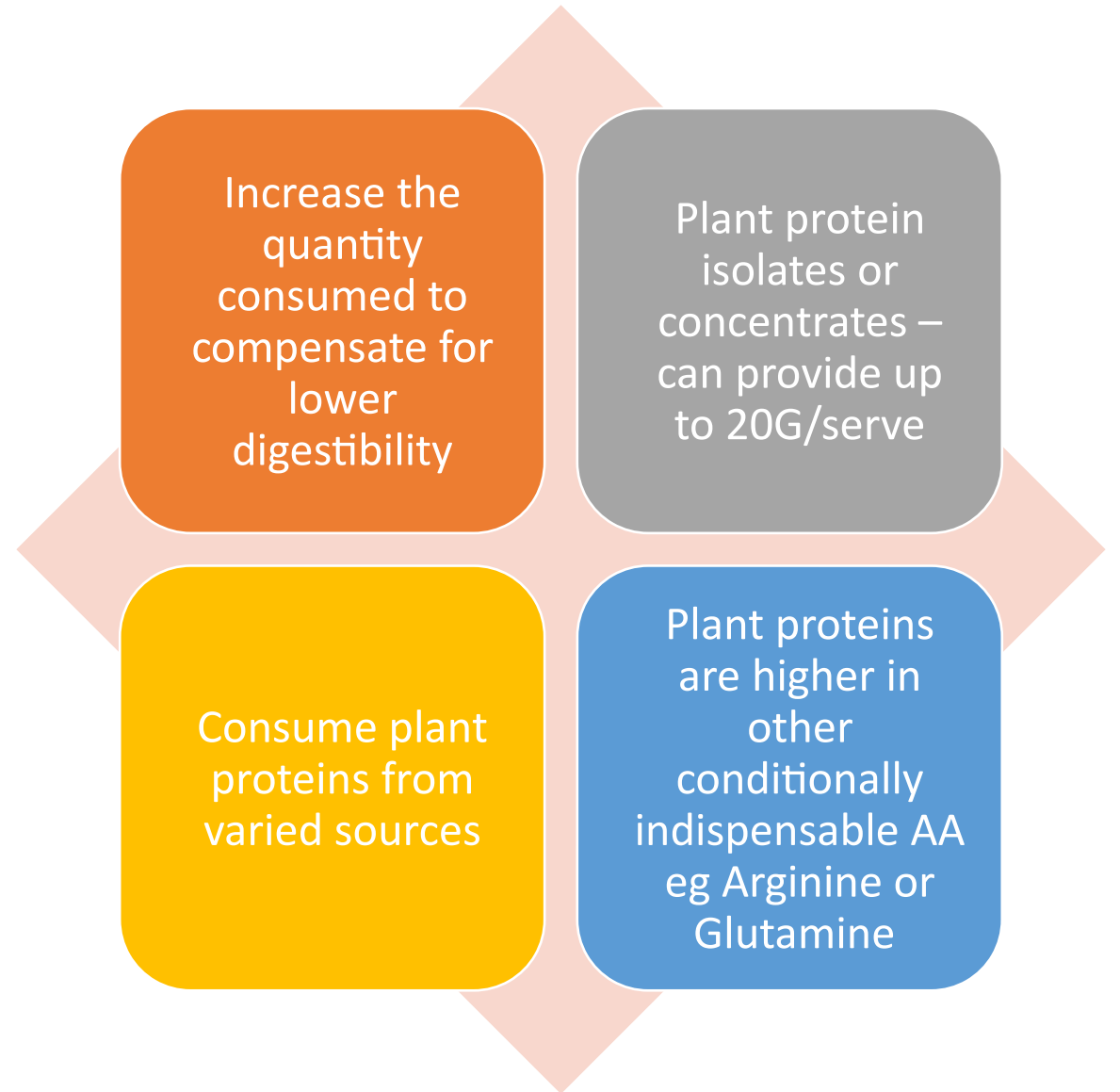
Institute of Medicine of the National Academies . *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids*. National Academies Press; Washington, DC, USA: 2005.

Protein Source	PDCAAS (FAO)	Limiting Amino acid/s
Milk	1.0	None
Whey	1.0	Histidine
Soy	0.9	SAA (Meth, Cysteine)
Pea	0.83	SAA, Tryp
Quinoa	0.78	Leu, Lys, Thr,Val

Some proteins though incomplete are rich in conditionally indispensable amino acids



How to improve EAA intake through plant proteins



Soy a good example of plant protein

- Complete protein with all 9 essential Amino Acids
- 100Gms Raw beans = 36.5 Gm Protein (USDA)
- The digestibility of soy foods - steamed soybeans 65.3%, tofu 92.7%, soy milk 92.6%, and soy protein isolate 93–97%(Wikipedia)
- Best Vegetarian protein

Why is Soy protein beneficial

- PDCAAS of milk protein / Soy Protein : 1.0/0.93 to 1.00 @
- DIAAS. „ „ : 1.08/ 0.92 @
- PDCAAS of Potato , Pea, other legumes , Quinoa – 0.75 to 0.91
- @ Steven RH et al ; Plant Proteins: Assessing Their Nutritional Quality and Effects on Health and Physical Function; [Nutrients](#). 2020 Dec; 12(12): 3704

Pediatr Gastroenterol Hepatol Nutr

. 2021 May;24(3):316-324.

doi: 10.5223/pghn.2021.24.3.316.Epub 2021 May 4.

Growth Patterns of Indonesian Infants with Cow's Milk Allergy and Fed with Soy-Based Infant Formula

[Budi Setiabudiawan¹](#), et al

Results: Based on the World Health Organization growth chart, we found that most of subjects had normal nutritional status for weight-for-age, length-for-age, weight-for-length, and head-circumference-for-age.

There were statistically significant differences between baseline and end-line for weight-for-age, length-for-age, weight-for-length, and head circumference-for-age nutritional status.

No allergic symptoms or intolerance toward soy formula were observed at the end of the intervention period.

Conclusion: These results show that infants fed with soy-based infant formula have a normal pattern of growth.

Environment effect through Green House Gases(CO₂, CH₄, N₂O, Fluorinated gases) generated to produce food*

- Highest – Lamb, Goat, Beef
- Intermediate- Milk and Cheese, Pork, Poultry
- Lowest- Eggs, Nuts, Rice, Lentils, Millets
- 6Kg Plant protein is required to produce 1Kg animal protein

- Total food related emissions = 34% of total GHG
- 35% of this comes from Livestock and rice cultivation

* Emissions Database of Global Atmospheric research(EDGAR)

Disadvantages of animal protein

Higher risk of

Heart Disease

T2DM

Stroke

Cancer

Ethical consideration

Except Poultry and Fish

Advantages of Plant Proteins

Less expensive

Less GHG, sustainable

Lower risk of NCD- Overall diet + Plant proteins

Benefits of Phytonutrients eg Soy Isoflavones, Carotenoids.

Advantages of Plant Proteins

- Beneficial in CKD patients since plant proteins are reno protective
- Type2 Diabetes Mellitus- Risk reduction studies equivocal
- Longevity and Mortality reduction
- Overall- Health benefits of Plant proteins are not for isolated proteins but for whole plant as food

Muscle Protein Synthesis(MPS) and Plant Proteins 1

- Total Protein Intakes – 20 to 40Gms and Leucine 2- 4gms
- Best results with combination of Whey and plant proteins
- Higher levels of Plant protein (>40G/day) needed to increase Leucine to match with Whey for better muscle protein synthesis (Hertzler et al Nutrients , 2020, 12, 3704)
- Rice or pea protein at 50 to 75 g/day had same muscle mass increase as whey protein with resistance training (Kalman et al . EC Nutr. 2018, 13, 6., Babault,et al . J. Int. Soc. Sports Nutr. 2015, 12, 3.)
- PER determinations in rats with 30:70 animal:plant ,resulted in equivalent or greater PER scores than did the animal protein at 100% [Hernandez, M.et al . J. Nutr. 1996, 126,574–581.].

Muscle Protein Synthesis(MPS) and Plant Proteins- 2

- Two studies of a protein blend (20 g) containing 25% whey protein isolate, 25% soy protein isolate, and 50% sodium caseinate can promote MPS to a level equivalent to whey protein alone(Reidy, et al,J. Appl. Physiol. 2014, 116, 1353–1364; Reidy, et al.. J. Nutr. 2013, 143, 410–416.)

Potential Negative effects of Plant proteins

- Antinutrient adverse effects- eg leaky gut and autoimmune effects (e.g., lectins and some saponins),
- Protein maldigestion (trypsin and protease inhibitors),
- Carbohydrate maldigestion (alpha-amylase inhibitors), mineral malabsorption (phytates, tannins, and oxalates)
- Interference with thyroid iodine uptake (goitrogens), gut dysfunction, inflammation
- Behavioral effects (conversion of cereal gliadins to exorphins)
- Processing eliminates most of them

Allergenicity of proteins

All proteins both animal and plant can have allergenic epitopes

Warning labels may be mandatory.

Allergen Databases

Processing may not eliminate

Thermal resistance- even in cooked food

Protein Hydrolysates are less allergenic

Thank You for
your attention

