FATs — overview for a protein-powder context

What are dietary fats?
Fats are energy-dense macronutrients composed of fatty acids. They are essential for energy, absorption of fat-soluble vitamins (A, D, E, K), cell membrane structure, hormone synthesis and making signalling molecules (e.g., eicosanoids).

Important types (simple terms)

- **Saturated fatty acids (SFA)** — solid at room temp; limited in healthy diets.
- **Monounsaturated fatty acids (MUFA)** — olive oil, avocado; generally heart-friendly.
- **Polyunsaturated fatty acids (PUFA)** — includes **omega-6** (linoleic acid, LA) and **omega-3** (alpha-linolenic acid, ALA; long-chain EPA/DHA).
- **Trans fats** — industrial trans fats should be avoided.

Essential fatty acids (EFA): LA (omega-6) and ALA (omega-3) — RDA / AI and sources

- **Alpha-linolenic acid (ALA, omega-3)**
    - **Adequate intake (AI): Women ≈ 1.1 g/day; Men ≈ 1.6 g/day** (IOM/NIH values commonly used). Sources: flaxseed / flax oil, chia, walnuts, canola oil, soy. Office of Dietary Supplements+1
- **Linoleic acid (LA, omega-6)**
    - **Minimal adequate intake: ~3–6 g/day** for adults (intake varies by calorie needs). Main sources: vegetable oils (sunflower, safflower, soybean, corn), nuts, seeds. NCBI+1
- **EPA + DHA (long-chain omega-3s)**
    - For general cardiovascular & cognitive health many authorities recommend **~250–500 mg/day combined EPA+DHA** for healthy adults; **~1 g/day** is commonly recommended when there is established coronary heart disease; higher therapeutic doses (e.g., 2–4 g/day) are used under medical supervision (e.g., to lower triglycerides). Main sources: fatty fish (salmon, mackerel, sardines) or algal oil (vegan DHA). European Food Safety Authority+1

Benefits (how they work — mode of action)

- **Cell membranes & fluidity:** long-chain PUFAs (EPA/DHA) incorporate into cell membranes affecting receptor function and membrane signalling.
- **Precursor to signalling molecules:** LA → arachidonic acid → pro-/anti-inflammatory eicosanoids; EPA → less pro-inflammatory eicosanoids and specialized pro-resolving mediators (anti-inflammatory).
- **Cardio & brain effects:** EPA/DHA modulate triglycerides, platelet aggregation, endothelial function and neuronal membrane composition. PMC+1

Deficiency & clinical clues

- **EFA deficiency (rare in well-fed adults):** dry scaly skin (dermatitis), poor wound healing, growth retardation in children, increased susceptibility to infections.
- **Low omega-3 status:** may correlate with higher inflammation markers, higher triglycerides, and (in some studies) worse cognitive outcomes.

Clinical settings where EFAs (or protein powder with EFAs) may be useful

- **Cardiovascular risk / hypertriglyceridaemia** — EPA/DHA as part of diet or prescription omega-3 in higher doses. Office of Dietary Supplements
- **Pregnancy / lactation** — DHA for fetal brain/eye development (recommendations often single out ~200–300 mg DHA/day). ScienceDirect
- **Inflammatory conditions / metabolic health** — adjunctive dietary strategy (not a primary therapy).
- **General wellness / brain health** — inclusion of small amounts of long-chain omega-3s can be marketed for cognitive support (with appropriate claims and disclaimers).

AMINO ACIDS & PROTEIN — core info for protein-powder

Basic overview

Proteins are chains of amino acids (AA). Of the 20 AAs, **9 are indispensable/essential** in adults — they must be supplied in the diet: **histidine, isoleucine, leucine, lysine, methionine (+ cysteine considered sulphur donors), phenylalanine (+ tyrosine), threonine, tryptophan, valine**. These are critical for tissue repair, enzymes, hormones, immune proteins, neurotransmitters and more. PMC

Protein RDA (whole-protein)

- **WHO / FAO / UNU / International consensus: ~0.8 g protein/kg body weight/day** for healthy sedentary adults (this is the commonly cited baseline). PMC+1
- **ICMR (India, 2020):** recommends **~0.83 g/kg/day** for healthy Indian adults; note the ICMR committee flags that **for cereal-based low-quality protein diets the practical requirement may be higher (~1.0 g/kg/day)** because of lower digestibility/limiting amino acids. ICMR National Institute of Nutrition+1
- **Higher needs:** athletes, pregnancy, lactation, illness, recovery from surgery/trauma and older adults often need **more** (e.g., 1.2 g/kg/day or higher depending on condition and guidance).

Indispensable amino acid recommended amounts (adult mg/kg/day)

(FAO/WHO/UNU / WHO tables used for formulation guidance; these represent **mg per kg body weight per day**):

- Histidine ≈ **10 mg/kg/day**
- Isoleucine ≈ **20 mg/kg/day**
- Leucine ≈ **39 mg/kg/day**
- Lysine ≈ **30 mg/kg/day**
- Methionine + Cysteine (sulphur AA) ≈ **14.5 mg/kg/day (total)**
- Phenylalanine + Tyrosine ≈ **25 mg/kg/day (total)**
- Threonine ≈ **15 mg/kg/day**
- Tryptophan ≈ **4 mg/kg/day**
- Valine ≈ **26 mg/kg/day**
  (These are average adult requirements used to assess protein quality and to design EAA blends). Iris+1

Key roles & benefits (amino acids)

- **Leucine:** triggers muscle protein synthesis (via mTOR signalling). Important in recovery, muscle maintenance, sarcopenia prevention. PMC
- **Lysine:** protein synthesis, collagen formation, immune support.
- **Methionine / cysteine:** methylation, glutathione (antioxidant) precursor.
- **Tryptophan:** serotonin precursor (mood & sleep regulation).
- **Branched-chain amino acids (BCAA: leucine, isoleucine, valine):** used frequently for muscle recovery & exercise nutrition (but whole-protein with complete EAA profile is generally preferred).

Deficiency signs (protein / EAA)

- **Low protein / EAA intake** → muscle wasting, poor wound healing, edema, immune dysfunction, growth failure in children, anaemia (from low globulins), fatigue. Specific AA deficiencies are rare in balanced diets but can manifest as targeted metabolic problems (e.g., low tryptophan → mood/sleep impacts; low methionine → impaired methylation). PMC

Clinical uses of protein / EAA-enriched powders

- **Sarcopenia & older adults** — help maintain lean mass (often paired with resistance exercise). Consider higher protein intake (≥1.0–1.2 g/kg/d) and leucine-rich servings (~2.5–3 g leucine per meal) to stimulate MPS. Frontiers+1
- **Post-surgical / trauma / critical illness** — protein supplementation supports wound healing and nitrogen balance (dose individualized by clinician). ScienceDirect
- **Malnutrition & recovery** — provide balanced EAA to restore lean mass.
- **Athletic performance & recovery** — 20–40 g of high-quality protein (containing ~2.5–3 g leucine) around training supports recovery & hypertrophy. EatingWell+1

Important caution: In advanced renal disease (e.g., CKD with low GFR), protein dosing requires clinician supervision (protein restriction may be recommended in some stages). Always include appropriate warnings. ScienceDirect

---

Leucine "threshold" and practical serving targets for protein powders

- Research and expert consensus indicate **~2.5–3.0 g leucine per meal** (or per serving) is effective to robustly trigger muscle protein synthesis in older adults and useful as a target in protein supplements intended to support muscle maintenance/rehabilitation. For younger adults, lower leucine per serving may still be effective, but many

commercial whey products contain ~2.5–2.8 g leucine per typical serving (20–30 g protein). PMC+1

PRODUCT / FORMULATION & LABELLING SUGGESTIONS for a protein powder (Alcardia Life Sciences)

Protein quality targets per serving (example — single scoop)

- **Protein amount:** 20–30 g high-quality protein per serving (adjust to target audience: sports vs clinical). EatingWell
- **Leucine target: ≥2.5 g leucine per serving** (to stimulate MPS, especially for older adults). Achievable with whey/isolates or leucine-enriched EAA blends. Frontiers+1
- **EAA content:** aim to supply a substantial fraction of daily indispensable AA needs — e.g., **~6–12 g EAA per serving** (depending on protein dose) — important for clinical formulations. Example: many whey proteins supply ~10–12 g EAA per 25 g protein serving. Muscleblaze
- **Optional fat inclusion (for a "complete recovery" formula):** small amount of MUFA/PUFA (e.g., 1–3 g of oil such as flaxseed or algal oil) can supply ALA or DHA; alternatively label "contains omega-3 (ALA/EPA/DHA)" if included. If you include EPA/DHA, consider **~250–500 mg EPA+DHA** per daily usage if marketing heart/brain support — but ensure regulatory & claim compliance. European Food Safety Authority+1

Example per-serving (illustrative formulation for a "recovery + heart-support" scoop)

- Whey protein isolate — **25 g** (provides ~20–24 g protein) → ~**2.6–3.0 g leucine** (typical). Dymatize+1
- Flaxseed powder or microencapsulated algal oil — **provides 1 g ALA** or **250 mg DHA** (choose plant or marine source per label). Office of Dietary Supplements+1
- Minimal sugar, appropriate flavouring, digestive enzymes (optional).
  (Adjust amounts, allergen statements, and clinical claims to local regulations.)

Label & claim language (examples)

- **"High-quality whey protein — 24 g protein per scoop; provides X g of branched-chain amino acids, including ~2.6 g leucine to support muscle recovery."** (only if lab analytics confirm). Dymatize
- *"Contains omega-3 (ALA / DHA) — helps support heart and brain health when consumed as part of a balanced diet."** (*only if clinically meaningful amounts are present and compliant with local claims regulations). European Food Safety Authority

---

Quick practical guidance for clinicians / patients (short)

- **Older adults / rehab:** target **≥1.0–1.2 g protein/kg/day** (divide across meals) and use **leucine-rich servings (~2.5–3 g leucine)** with resistance exercise where possible. BPS Publications+1
- **Athletes:** 1.4–2.0 g/kg/day (depending on training), 20–40 g protein per meal, 0.25–0.4 g/kg per serving recommended around workouts. EatingWell
- **Cardio patients:** aim dietary EPA+DHA **~250–1000 mg/day** depending on guideline and clinical context — discuss with treating physician. Office of Dietary Supplements+1

References (authorities I used)

1. **ICMR-NIN Recommended Dietary Allowances for Indians (2020)** — protein RDA 0.83 g/kg and notes on cereal-based diets. ICMR National Institute of Nutrition+1
2. **WHO / FAO / UNU report and FAO/WHO amino acid requirement tables** — indispensable amino acid mg/kg/day values. Iris+1
3. **NIH / ODS – Omega-3 Fatty Acids fact sheet** — ALA averages and clinical notes on EPA/DHA recommendations. Office of Dietary Supplements
4. **NCBI / Nutrition textbooks & reviews** — linoleic acid minimal intake and PUFA guidance.
5. **Leucine / MPS literature & reviews** — leucine threshold ~2.5–3 g/meal and relevance to older adults and product targets.