The Best Whole-Food Sources of Human Essential Nutrients

The Information I Believe Should Shape Your Food Choices AS a SEND (Special Needs) Caregiver, and Why

RICKY DU PLESSIS
JUL 13, 2026

Why this essay exists

Across my recent posts I've made three claims in sequence: that nourishment matters more than calories; that "essential" nutrients are the non-negotiable raw materials your body cannot make; and that it's not what's *in* a food that counts, but what your body can absorb and use — bioavailability. This essay puts those together and answers the practical question they raise: *for each essential nutrient, what is the best whole-food source?*

I'm not going to tell you what diet to follow. My aim is to give you the criteria to judge food for yourself, apply them honestly, and let you draw your own conclusions.

Part 1: How to Judge a Food — and Essential Amino Acids

The selection criterion

For each essential nutrient, I'm identifying the best source by four tests, applied together:

- **Bioavailability** — is the nutrient in a form the body can readily absorb and use, or a precursor requiring inefficient conversion?

- **Nutrient density** — how much of the nutrient per portion, and what else of value rides along with it?
- **Whole and minimally processed** — is it obtainable from a whole food with no more than simple cooking? If a food needs elaborate processing (fermenting, industrial extraction, soaking to defeat its own defence compounds) to make a nutrient available, that counts against it.
- **Net payload** — does the food carry a significant load of anti-nutrients (compounds that block absorption) or non-essential components (such as a large carbohydrate load) that detract from, rather than add to, its nourishment?

This last test matters most, and it's where my approach differs from the standard nutrition metrics. The mainstream scores tend to isolate a single nutrient and rate it alone. But you don't eat isolated nutrients — you eat whole foods, and a food's real value is the nutrient *net of everything it brings with it*. A source that delivers a nutrient but drags a metabolic cost along with it is a compromised source, however well it scores in isolation.

Essential Amino Acids — the building blocks

There are twenty amino acids the body uses to build proteins. Nine of them are *essential*: the body cannot synthesise them, so they must come from the diet. These nine are histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine (National Center for Biotechnology Information, 2024; MedlinePlus, 2025).

They aren't only for muscle — they build hormones, enzymes, red blood cells, and the neurotransmitters that regulate mood, sleep and focus. Tryptophan is the precursor to serotonin; phenylalanine feeds dopamine and noradrenaline; histidine makes histamine (MedlinePlus, 2025; National Center for Biotechnology Information, 2024). Undersupply the building blocks and it isn't only the body that feels it — it's the mind.

A food that contains all nine in adequate proportion is called a *complete protein* (Institute of Medicine, 2005). This is where the first honest distinction lies. Completeness alone isn't the whole story — a food can be technically complete yet poorly digestible, or complete only in an isolated extract you'd never eat as a whole food.

Bioavailability — the evidence. The current international standard for protein quality, endorsed by the FAO, is the Digestible Indispensable Amino Acid Score (DIAAS), which measures how much of each essential amino acid is actually absorbed at the small intestine (Adhikari et al., 2022). On this measure, the pattern is consistent: animal-source protein foods score highest, with pork, casein (dairy), and egg classified as excellent-quality proteins at average DIAAS above 100 (Herreman et al., 2020); among plant groups, only a small number (soy-based products and mung bean) reach above 90% (Adhikari et al., 2022).

Applying the full criterion — the honest caveat. That same review found potato protein also scored above 100 (Herreman et al., 2020). Taken at face value, that looks like a plant protein matching animal sources. But this is exactly where isolated scoring misleads, and where the fuller criterion earns its place. Two things:

First, the DIAAS figure is for *potato protein isolate* — an industrially extracted fraction, not a food you eat. To obtain that protein from an actual potato, you eat the whole potato: per 100g, a raw potato provides roughly 17.5g of carbohydrate for about 2g of protein — around 91% of its calories come from carbohydrate, a roughly 9-to-1 carbohydrate-to-protein ratio (USDA FoodData Central, 2024). To reach a meaningful protein intake from potato you would ingest a very large carbohydrate load — and a cooked potato is high-glycaemic (a baked potato has a glycaemic index around 85) (USDA FoodData Central, 2024). For a SEND caregiver who depends on stable fuel to hold steady energy and mood through a relentless day, that carbohydrate load drives exactly the blood-sugar spike-and-crash the rest of this work is about avoiding. The protein may be high quality; the *package* it arrives in imposes a metabolic cost that works against the goal.

Second, it's worth noting the research itself frames plant-protein "completeness" carefully: complementarity — combining plant proteins to fill each other's gaps — is recommended only at the level of a single meal, not across a whole diet (Adhikari et al., 2022). In other words, the reassurance that "a varied plant diet covers it" is more conditional than it's often made to sound.

By contrast, an egg or a piece of meat delivers complete, highly bioavailable protein with negligible carbohydrate and a substantial payload of *other* essential nutrients riding along — density without a countervailing cost.

Best whole-food sources of complete, bioavailable essential amino acids: eggs, meat (beef, poultry) and fish per Table 1 below (Herreman et al., 2020; National Center for Biotechnology Information, 2024).

Nutrient	The 9 essential amino acids (as complete protein)
Most bioavailable delivery	Complete protein, high DIAAS (>100 / "excellent")
Best whole-food source(s)	Eggs, meat, fish
Why (net criterion)	Complete + highest measured digestibility + negligible anti-nutrient / carbohydrate payload

Table 1: Essential Amino Acids

Part 2: Essential Fatty Acids

Fats are not merely fuel. They are structural. Cell membranes throughout your body are built from them, and the brain depends on specific fatty acids for its architecture and function.

The essential fatty acids for human beings are:

- **Linoleic acid (LA)** — omega-6
- **Alpha-linolenic acid (ALA)** — omega-3
- **Arachidonic acid (AA)** — omega-6
- **Eicosapentaenoic acid (EPA)** — omega-3
- **Docosahexaenoic acid (DHA)** — omega-3

Convention tends to list only LA and ALA as "essential," on the grounds that the body can synthesise AA, EPA and DHA from them. But apply the definition of essentiality properly — a nutrient the body cannot synthesise *in adequate amounts*, and which must therefore be obtained from the diet — and that convention does not survive contact with the evidence.

The conversion does not work. Measured in humans, fractional conversion of ALA to EPA ranges from roughly 0.3% to 8% in men, and conversion of ALA to DHA is under 4% — *often undetectable in males altogether*. Women convert somewhat better, up to around 21% to EPA and up to 9% to DHA, a difference attributed to hormonal factors (Arterburn, Hall and Oken, 2006). A large proportion of dietary ALA is simply oxidised for energy, and because interconversion is so limited, ALA supplementation does not result in appreciable accumulation of long-chain omega-3s in plasma (Arterburn, Hall and Oken, 2006).

The formal position statement of the International Society for the Study of Fatty Acids and Lipids reaches the same conclusion: no level of ALA tested raises DHA to the levels achievable with pre-formed DHA (Brenna et al., 2009).

Two further factors suppress conversion. LA and ALA compete for the *same* enzymes — so the omega-6-saturated modern diet actively crowds out omega-3 conversion, pushing production toward AA instead (Linus Pauling Institute, 2026a). And genetic variability in the relevant desaturase enzymes adds further individual variation (Linus Pauling Institute, 2026a).

A pathway that delivers under 4% — and in many men, nothing at all — is not a pathway that supplies adequate amounts. By the definition of essentiality itself, AA, EPA and DHA must come from the diet. They are essential.

Even the mainstream concedes the practical point while retaining the technical label: because conversion may not be sufficiently efficient, EPA and DHA are best obtained directly from food (Harvard T.H. Chan School of Public Health, 2024). The Linus Pauling Institute acknowledges that the low conversion rate suggests these long-chain omega-3s may be considered conditionally essential (Linus Pauling Institute, 2026a). The literature is edging toward the position. The evidence is already there.

Applying the criterion. ALA is abundant in flaxseed, chia and walnuts — but as a source of the fats your brain is actually built from, these fail the first test: the nutrient arrives as a *precursor* dependent on a conversion that largely doesn't happen. Pre-formed EPA and DHA are found in oily fish — salmon, mackerel, sardines, herring — as whole foods, needing nothing more than cooking, with no anti-nutrient load and no carbohydrate payload (Harvard T.H. Chan School of Public Health, 2024). AA is found pre-formed in meat, poultry, eggs and fish. LA and ALA are also present in animal foods, so a diet built on them is not short of the parent fats either.

Nutrient	Essential fatty acids: LA, ALA, AA, EPA, DHA
Most bioavailable delivery	Pre-formed AA, EPA, DHA—not the precursors, whose conversion runs at single-digit percentages or fails entirely
Best whole-food source(s)	Oily fish (salmon, mackerel, sardines, herring); eggs; meat
Why (net criterion)	Delivers the finished structural fats directly—no conversion lottery, no anti-nutrients, no carbohydrate load

Table 2: Essential Fatty Acids

Part 3: Essential Vitamins

Humans require 14 essential vitamins. Four are fat-soluble (A, D, E and K) — absorbed alongside dietary fat and stored in the body. The remaining ten are water-soluble (the B-complex, choline and vitamin C) — poorly stored and needing regular replacement.

Unlike the fatty acids, the vitamins do not tell one single story. Three different questions decide where the best source lies, and which question applies varies by nutrient:

For vitamins A, D and K, the question is form. These follow the same pre-formed-versus-precursor logic established in Part 2. Vitamin A exists as retinol in animal foods and as beta-carotene — a precursor — in plants, and the conversion is poor and highly variable. Vitamin D exists as D3 (cholecalciferol) in animal foods and as D2 (ergocalciferol) in fungi; the evidence on whether the two are equivalent is unsettled, but very few foods contain vitamin D at all, and the richest are animal. Vitamin K exists as menaquinones (K2), largely in animal foods, and as phylloquinone (K1) in plants, which is bound within chloroplasts and barely absorbed. In each case, plants supply a version of the nutrient that your body must convert or struggle to extract; animal foods supply the finished article.

For the B-complex, biotin, folate and choline, the question is density and payload. These nutrients occur in both plant and animal foods, but at very different concentrations — and the richest plant sources routinely arrive attached to a heavy carbohydrate load (potatoes, cereals, legumes) or an anti-nutrient burden (phytate in grains and nuts; oxalate in certain greens; tannins, which inactivate thiamin). Organ meats, eggs and dairy deliver the same nutrients densely and cleanly.

For vitamins C and E, the criterion points elsewhere — and I report that as I find it. The densest, most usable sources are plant foods: peppers, berries and broccoli for vitamin C; almonds and sunflower seeds for vitamin E. Two of the fourteen do not fit the pattern. That is not a weakness in the method. It is evidence that the method is a rule being applied, rather than a conclusion in search of support.

Table 3 below applies all four tests to each of the fourteen.

Vitamin	Most bioavailable form	Best whole-food source	Rationale under the criterion
A	Retinol (pre-formed)	Liver, egg yolk, butter	Beta-carotene converts to retinol at only 3.6:1 to 28:1 by weight — leafy vegetables are the *least* efficient at 28:1. The Food and Nutrition Board revised its official factor from 6:1 to 12:1. Pre-formed retinol is absorbed and stored efficiently (Tang, 2010)
D	D3 (cholecalciferol)	Oily fish, egg yolk, liver	D2/D3 equivalence is unsettled, but the richest dietary sources are not in dispute. Sunlight remains the primary route (National Institutes of Health, 2025b)
E	α-tocopherol	Almonds, sunflower seeds	Nuts and seeds are the densest sources; phytate binds minerals, not fat-soluble vitamins. **But** the requirement rises with PUFA intake — a diet low in polyunsaturated fat needs less (National Institutes of Health, 2025n; National Research Council, 1989)
K	K2 (menaquinones)	Egg yolk, butter, liver, hard cheese	K1 is bound within plant chloroplasts and absorbed at only ~10% (Linus Pauling Institute, 2026b). Menaquinone intake — not phylloquinone — was associated with lower coronary calcification (Booth, 2012; EFSA, 2017; National Institutes of Health, 2025c)
B1 (thiamin)	Thiamin	Pork, liver	Meat, especially pork, is the richest natural source; population survey data confirm meat as the main dietary source. Tannins (tea, coffee, legumes) inactivate thiamin (Mielgo-Ayuso et al., 2018)
B2 (riboflavin)	Riboflavin	Liver, dairy, eggs	Organ meats, eggs and dairy are the major sources; dairy is the leading dietary source in survey data (Mielgo-Ayuso et al., 2018)
B3 (niacin)	Niacin	Liver, meat, poultry, fish	Meat is the main dietary source. Complete protein also contributes indirectly — 60 mg of tryptophan yields 1 mg of niacin (Institute of Medicine, 1998; Mielgo-Ayuso et al., 2018)
B5 (pantothenic acid)	Pantothenic acid	Liver, kidney, egg yolk, chicken, beef	Named among the major sources alongside potatoes, oat cereals and whole grains — which fail on carbohydrate load (Institute of Medicine, 1998)
B6 (pyridoxine)	Pyridoxal-5-phosphate	Fish, poultry, liver, meat	Meat is the main dietary source in population data (Mielgo-Ayuso et al., 2018)
B12 (cobalamin)	Cobalamin	Liver, shellfish, red meat	Plant foods contain **no** B12 unless fortified; natural sources are limited to animal foods (National Institutes of Health, 2025a)
Biotin	Biotin	Liver, egg yolk	Liver and egg yolk are the richest dietary sources (Institute of Medicine, 1998)
Folate	Food folate	Liver	Liver is named among the foods with the highest folate levels. Spinach ranks alongside it but carries an oxalate burden; folate also degrades with cooking and storage (National Institutes of Health, 2025o)
Choline	Choline	Liver, egg yolk, red meat	The richest sources are liver, egg yolks and red meat; the body synthesises some but not enough to meet requirements (National Institutes of Health, 2025p)
C	Ascorbic acid	Peppers, berries, broccoli	Peppers, kiwifruit, broccoli and strawberries are among the richest sources — whole, raw, low carbohydrate. Baked potatoes appear on the list but fail on carbohydrate load (National Institutes of Health, 2025q)

Table 3: Essential Vitamins

A note on vitamin E.

Two of the fourteen — vitamin C and vitamin E — do not land on animal foods, and I report that as the criterion finds it. But vitamin E deserves a closer look, because the table cannot show the whole picture.

First, **we eat meals, not isolated nutrients.** Nuts and seeds carry phytate, and phytate does not confine its effects to the food containing it: it inhibits the absorption of non-heme iron, zinc, calcium and magnesium *across the entire meal*. A handful of almonds alongside a mineral-rich plate exacts a cost that no per-nutrient table can display. (Heme iron is largely resistant to this inhibition — one more advantage of the animal form.)

Second, and more fundamentally: **the vitamin E requirement is not fixed.** Its principal role is protecting polyunsaturated fats from oxidation, and the requirement rises with polyunsaturated fat intake (National Research Council, 1989). A diet built on stable animal fats, free of industrial seed oils, imposes a substantially lower vitamin E demand than one saturated with them. The modern vitamin E "requirement" is, in significant part, a consequence of the modern fat supply. The question is not only *where do I get more vitamin E* — it is *why do I need so much of it in the first place?*

Part 4: Essential Minerals

Humans require 15 essential minerals — seven macro-minerals, needed in larger amounts, and eight trace minerals, needed in small ones.

Minerals differ from vitamins in one crucial respect: there is no "pre-formed versus precursor" problem. A mineral is an element; it cannot be converted into something else. So the question of the best source turns entirely on the remaining three tests — density, absorption, and what else the food brings with it. And here the anti-nutrient question — already relevant to several of the B vitamins — becomes decisive.

The anti-nutrient problem is real, and it is measurable

Phytate (phytic acid), found in grains, legumes, nuts and seeds, binds minerals in the gut and blocks their absorption. Its inhibitory effect on iron is dose-dependent (National Center for Biotechnology Information, 2023).

This is not a theoretical concern. In a double-isotope absorption study in healthy women, non-heme iron absorption from 80g of high-phytate wholegrain rye bread was 7.0%; from an identical loaf in which the phytate had been degraded by sourdough fermentation, absorption was 19.1% — **2.8 times higher** (Hoppe, Sandberg and Hulthén, 2025). The iron was present in both loaves in the same quantity. The entire difference lay in what the food was doing to block it.

Oxalate, found in spinach and certain other greens, binds calcium and iron in the same manner (National Institutes of Health, 2025j).

This is the crux of what I call *gaming the system*. If a food requires soaking, sprouting, fermenting or industrial processing to release nutrients it is actively withholding, then it is not an ideal source of them. And crucially, this inhibition operates **at the level of the whole meal** — the phytate in a handful of nuts does not merely block the minerals in the nuts. It blocks the minerals in everything eaten alongside them.

Which is why a per-nutrient table, read naively, misleads. Nobody eats a single food in isolation to obtain a single nutrient. A source that is "richest on paper" but which suppresses absorption across the entire meal is not the best source of anything. It is a liability wearing the costume of a nutrient.

Iron — the decisive case

There are two forms of dietary iron. **Heme iron** derives from haemoglobin and myoglobin in meat, poultry and seafood. **Non-heme iron** is the form found in plants and in iron-fortified foods.

Heme iron is absorbed at **15–35%** and is the most readily absorbable form (National Center for Biotechnology Information, 2023).

But the more important property is *robustness*. **Heme iron absorption is largely unaffected by dietary inhibitors.** Phytates and polyphenols suppress only non-heme iron absorption; heme iron bypasses them (National Center for Biotechnology Information, 2023). Non-heme absorption, by contrast, is passive, variable, and easily blocked by whatever else happens to be on the plate.

Best source: red meat, liver, shellfish.

Table 4 below lists the essential minerals and their best whole-food sources, while applying all four tests — bioavailability, density, whole and minimally processed, and net payload — rather than raw density alone:

Mineral	Best whole-food source	Rationale under the criterion
Iron	Red meat, liver, shellfish	Heme form absorbed at 15–35% and largely unaffected by dietary inhibitors; phytates and polyphenols suppress only non-heme iron (National Center for Biotechnology Information, 2023)
Zinc	Oysters, red meat, shellfish	Oysters contain more zinc per serving than any other food; zinc from beans, nuts and whole grains is phytate-bound and less bioavailable, and fruits and vegetables contain very little zinc (National Institutes of Health, 2025f)
Copper	Liver, organ meats, shellfish (oysters)	ODS lists shellfish and organ meats among the richest sources; the other rich sources — seeds, nuts, wheat-bran, whole grains, chocolate — fail on phytate, carbohydrate load or processing (National Institutes of Health, 2025i)
Selenium	Seafood, organ meats, meat, eggs	Selenium is bound to protein, so protein-rich foods are the best sources; plant selenium varies by soil, and Brazil nuts are inconsistent and carry a toxicity risk on regular consumption (National Institutes of Health, 2025e)
Iodine	Fish, shellfish, dairy, eggs, liver	Fruits, vegetables, beans, nuts and grains are low in iodine; seaweed is the richest source, but its content is highly variable and can deliver excessive doses (National Institutes of Health, 2025d)
Phosphorus	Dairy, meat, poultry, fish, eggs	Absorption of naturally-occurring phosphorus is 40–70%, and is higher from animal sources than plants; in plant seeds, grains, legumes and nuts phosphorus is stored as phytic acid, which humans lack the enzyme (phytase) to hydrolyse, so roughly half of it is unavailable (National Institutes of Health, 2025k; Linus Pauling Institute, 2026c)
Sulphur	Eggs, meat, fish	Sulphur is obtained chiefly as part of dietary protein, through the sulphur-containing amino acids methionine and cysteine. Eggs are among the highest sources; deficiency does not occur when protein needs are met. The answer therefore follows from Part 1 — the best source of bioavailable complete protein is the best source of sulphur (Institute of Medicine, 2005)
Calcium	Dairy; tinned fish with bones	Absorption from dairy is ~30% (27% for milk) versus only 5% from spinach, where oxalate and phytate form indigestible salts. Low-oxalate greens absorb comparably to milk but contain far less calcium per serving (National Institutes of Health, 2025j)
Potassium	Meat, fish, avocado, leafy greens	Potassium is highly bioavailable from plants (~94% absorption from potatoes) with no anti-nutrient barrier — so no bioavailability advantage accrues to animal sources here. The densest plant sources (potato, banana, dried fruit) fail on carbohydrate load; low-carb plants and animal foods both pass (National Institutes of Health, 2025l)
Sodium & Chloride	Salt; also present in meat and fish	No bioavailability barrier and no anti-nutrient contest — sodium chloride is the direct dietary source
Manganese	Mussels, clams, oysters	Shellfish are among the top sources — 3oz of cooked mussels provides 5.8 mg — without the phytate load of whole grains and nuts or the polyphenol load of tea (National Institutes of Health, 2025g)
Molybdenum	Beef liver, dairy	Legumes are the richest source but fail on carbohydrate load and phytate; grains and nuts likewise. Liver and milk are named among the top dietary sources and carry no inhibitory load (National Institutes of Health, 2025m)
Chromium	Egg yolk, broccoli	Meats contribute only 1–2 µg per serving, and processed meats test higher only because they acquire chromium from stainless steel equipment. Whole grains, bran and nuts fail on carbohydrate load and phytate. Note: the essentiality of trivalent chromium is itself questioned (Linus Pauling Institute, 2026d; Institute of Medicine, 2001)
Magnesium	Fish, dairy, lower-oxalate greens	The densest sources — nuts, seeds, grains and legumes — are high-fibre foods containing phytate, which decreases intestinal magnesium absorption by binding it to phytic acid (National Institutes of Health, 2025h; Institute of Medicine, 1997)

Table 4: Essential Minerals

The Absence That Speaks Loudest: Carbohydrate

Read back over the four classes of essential nutrient — amino acids, fatty acids, vitamins, minerals — and notice what never appears.

There is no essential carbohydrate.

This is not an oversight, and it is not a fringe position. It is stated plainly in the same Institute of Medicine reference volume that sets the dietary guidelines: *"The lower limit of dietary carbohydrate compatible with life apparently is zero, provided that adequate amounts of protein and fat are consumed"* (Institute of Medicine, 2005, p. 275).

The reason is **gluconeogenesis**. Your body manufactures its own glucose — from amino acids, from lactate, from the glycerol backbone of fat — continuously, in the liver and kidneys, whether or not you eat any carbohydrate at all. And when carbohydrate intake is low, the brain shifts substantially onto ketone bodies for fuel. Between the two, energy needs are met regardless of carbohydrate intake (Volek et al., 2024).

The distinction is subtle and it is everything: **your brain requires glucose. Your body does not require you to eat it.**

The objection, met head-on. The same DRI volume also sets a Recommended Dietary Allowance for carbohydrate of 130 g per day, and this figure is routinely cited as proof that carbohydrate is essential. It isn't. That RDA is derived from the average amount of glucose used by the brain — calculated on the assumption that the glucose arrives from the diet, and that the body is not fat-adapted (Institute of Medicine, 2005). It describes what a typical carbohydrate-based diet supplies. It does not establish a requirement. We know this because the very same chapter concedes that the lower limit compatible with life is zero.

So, carbohydrate is not a nutrient your body must obtain. It is a **fuel** — one of several, and the only one you can manufacture for yourself.

That reframes the question entirely. Carbohydrate does not get a free pass onto the plate by virtue of necessity. It has to earn its place like anything else — and once you look at what chronically elevated blood glucose actually does, the case for a large intake weakens considerably.

The cost of chronically elevated glucose

Two mechanisms matter here, and they compound.

Glycation. Glucose is a reactive molecule. It binds spontaneously to proteins, lipids and nucleic acids — no enzyme required, no regulation, no off-switch. The reaction is slow under normal conditions, but it is *markedly accelerated under persistent hyperglycaemia, simply because there is more glucose available to react* (Khalid, Petroianu and Adem, 2022). The end results are **advanced glycation end products (AGEs)** — permanently modified, cross-linked proteins whose structure and function are irreversibly damaged (Khalid, Petroianu and Adem, 2022).

This is not an abstraction. When your GP measures HbA1c, they are measuring glycated haemoglobin — glucose stuck to your red blood cells. The standard test for blood sugar control *is a glycation measurement*. The damage is already being quantified; we simply do not call it by that name.

Insulin resistance. AGEs bind to a cell-surface receptor called RAGE, and that interaction triggers oxidative stress and inflammation, disrupts insulin signalling, and is toxic to the pancreatic beta cells that produce insulin in the first place (Khalid, Petroianu and Adem, 2022). Experimentally, AGEs impair glucose handling by suppressing GLUT4 — the transporter muscle cells use to take glucose out of the blood — and this has been demonstrated **in non-diabetic states**, not only in established disease (Pinto-Junior et al., 2018).

Which closes a loop worth seeing clearly. Chronically elevated glucose accelerates glycation. Glycation produces AGEs. AGEs impair insulin signalling. Impaired insulin signalling elevates glucose further. It is self-reinforcing, and it runs quietly for years before anything shows up on a blood test.

Why this matters for a SEND caregiver

Insulin resistance and chronic low-grade inflammation are not distant concerns about a diagnosis decades away. They are the substrate of the metabolic dysfunction that erodes the very things you cannot afford to lose: stable energy, steady mood, working memory, emotional regulation. The machinery that lets you stay calm when your child cannot is the machinery this process degrades.

Let me be careful about what I am and am not claiming. I am not saying carbohydrate is poison. I am saying it is not *essential* — that is a matter of record, not opinion — and that a chronically elevated blood glucose carries a measurable, mechanistic cost. What you do with that is yours to decide. My argument is only that it should be a decision, rather than an assumption.

What to Take from This

Four things, if you take nothing else.

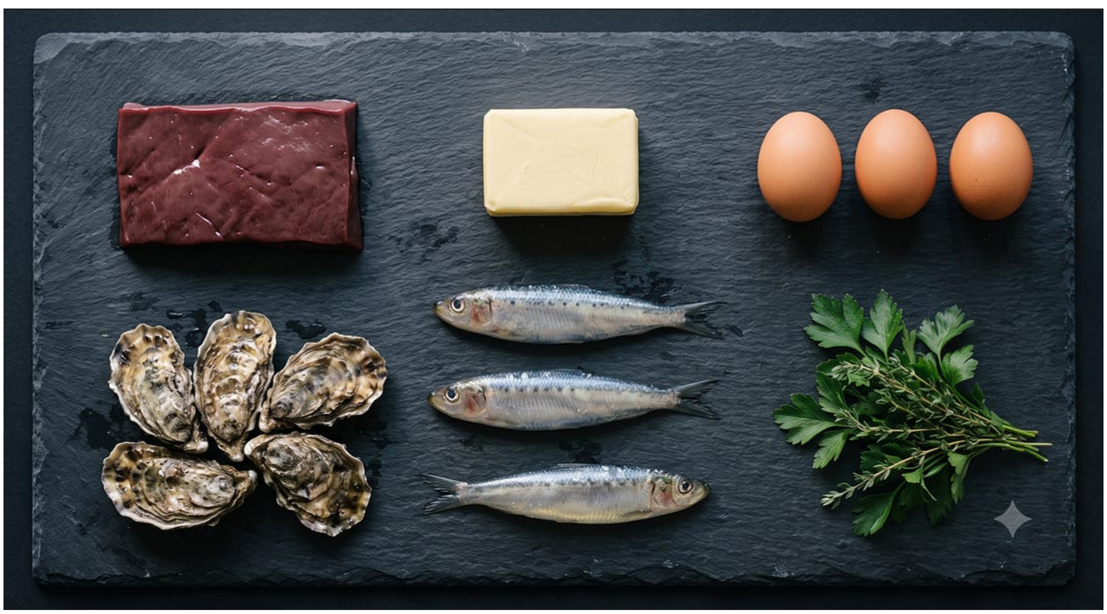
"Essential" is not a compliment — it is a specification. An essential nutrient is one your body cannot manufacture. If it is not on your plate, it is not in you, and over time the shortfall becomes disease. There are 44 of them: nine amino acids, five fatty acids, fourteen vitamins, fifteen minerals. Carbohydrate is not among them.

What is *in* the food is not what reaches your cells. Bioavailability is the difference between a number on a label and a nutrient in your bloodstream. Some foods hand you the finished article — retinol, DHA, heme iron, K2. Others hand you a precursor and leave your body to perform a conversion it often performs badly or lock the nutrient behind compounds designed to keep it. The label cannot tell you which is which. That is why the source matters as much as the nutrient.

Judge the whole food, not the nutrient in isolation. You do not eat nutrients; you eat meals. A food that is richest on paper, but which suppresses absorption across the entire plate, or which delivers its nutrient attached to a large carbohydrate load, is not the best source of anything — however well it scores in isolation. This is the single most important idea in this essay, and it is the one the standard nutrition metrics consistently miss.

Apply the criterion yourself and follow it honestly — even when it goes somewhere you did not expect. I have applied it here across all 44 essential nutrients, and reported what I found: overwhelmingly, the best whole-food sources are animal foods. But not universally. Vitamin C lands on peppers and berries. Vitamin E lands on nuts and seeds. Potassium lands in both camps. I report those because a rule that only ever produced one answer would not be a rule at all — it would be a conclusion wearing a rule's clothes.

I am not telling you what to eat. I am handing you the criteria and showing my working. The conclusion is yours to draw.



Pledge your support

References

Adhikari, S., Schop, M., de Boer, I.J.M. and Huppertz, T. (2022) ‘Protein quality in perspective: a review of protein quality metrics and their applications’, *Nutrients*, 14(5), 947. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC8912699/ (Accessed: 9 July 2026).

Arterburn, L.M., Hall, E.B. and Oken, H. (2006) ‘Distribution, interconversion, and dose response of n-3 fatty acids in humans’, *American Journal of Clinical Nutrition*, 83(6 Suppl), pp. 1467S–1476S. Available at: https://pubmed.ncbi.nlm.nih.gov/16841856/ (Accessed: 9 July 2026).

Booth, S.L. (2012) ‘Vitamin K: food composition and dietary intakes’, *Food & Nutrition Research*, 56. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC3321250/ (Accessed: 9 July 2026).

Brenna, J.T., Salem, N., Sinclair, A.J. and Cunnane, S.C. (2009) ‘α-Linolenic acid supplementation and conversion to n-3 long-chain polyunsaturated fatty acids in humans’, *Prostaglandins, Leukotrienes and Essential Fatty Acids*, 80(2–3), pp. 85–91. Available at: https://pubmed.ncbi.nlm.nih.gov/19269799/ (Accessed: 9 July 2026).

EFSA Panel on Dietetic Products, Nutrition and Allergies (2017) ‘Dietary reference values for vitamin K’, *EFSA Journal*, 15(5), e04780. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC7010012/ (Accessed: 9 July 2026).

Harvard T.H. Chan School of Public Health (2024) *Omega-3 fatty acids: an essential contribution*. The Nutrition Source. Available at: https://nutritionsource.hsph.harvard.edu/what-should-you-eat/fats-and-cholesterol/types-of-fat/omega-3-fats/ (Accessed: 9 July 2026).

Herreman, L., Nommensen, P., Pennings, B. and Laus, M.C. (2020) ‘Comprehensive overview of the quality of plant- and animal-sourced proteins based on the digestible indispensable amino acid score', *Food Science & Nutrition*, 8(10), pp. 5379–5391. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7590266/ (Accessed: 9 July 2026).

Hoppe, M., Sandberg, A.-S. and Hulthén, L. (2025) 'Influence of sourdough fermentation-induced dephytinization on iron absorption from whole grain rye bread — double-isotope crossover and single-blind absorption studies', *Nutrients*, 17(24), 3891. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC12735527/ (Accessed: 9 July 2026).

Institute of Medicine (1997) *Dietary reference intakes for calcium, phosphorus, magnesium, vitamin D, and fluoride*. Washington, DC: National Academies Press. Available at: https://www.ncbi.nlm.nih.gov/books/NBK109816/ (Accessed: 9 July 2026).

Institute of Medicine (1998) *Dietary reference intakes for thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, pantothenic acid, biotin, and choline*. Washington, DC: National Academies Press. Available at: https://www.ncbi.nlm.nih.gov/books/NBK114310/ (Accessed: 9 July 2026).

Institute of Medicine (2001) *Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc*. Washington, DC: National Academies Press. Available at: https://www.ncbi.nlm.nih.gov/books/NBK222329/ (Accessed: 9 July 2026).

Institute of Medicine (2005) *Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids*. Washington, DC: National Academies Press. Available at: https://www.ncbi.nlm.nih.gov/books/NBK234922/ (Accessed: 9 July 2026).

Khalid, M., Petroianu, G. and Adem, A. (2022) 'Advanced glycation end products and diabetes mellitus: mechanisms and perspectives', *Biomolecules*, 12(4), 542. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9030615/ (Accessed: 9 July 2026).

Linus Pauling Institute (2026a) *Essential fatty acids*. Micronutrient Information Center, Oregon State University. Available at: https://lpi.oregonstate.edu/mic/other-nutrients/essential-fatty-acids (Accessed: 9 July 2026).

Linus Pauling Institute (2026b) *Vitamin K*. Micronutrient Information Center, Oregon State University. Available at: https://lpi.oregonstate.edu/mic/vitamins/vitamin-K (Accessed: 9 July 2026).

Linus Pauling Institute (2026c) *Phosphorus*. Micronutrient Information Center, Oregon State University. Available at: https://lpi.oregonstate.edu/mic/minerals/phosphorus (Accessed: 9 July 2026).

Linus Pauling Institute (2026d) *Chromium*. Micronutrient Information Center, Oregon State University. Available at: https://lpi.oregonstate.edu/mic/minerals/chromium (Accessed: 9 July 2026).

MedlinePlus (2025) *Amino acids*. Available at: https://medlineplus.gov/ency/article/002222.htm (Accessed: 9 July 2026).

Mielgo-Ayuso, J., Aparicio-Ugarriza, R., Olza, J., Aranceta-Bartrina, J., Gil, Á., Ortega, R.M., Serra-Majem, L., Varela-Moreiras, G. and González-Gross, M. (2018) 'Dietary intake and food sources of niacin, riboflavin, thiamin and vitamin B6 in a representative sample of the Spanish population: the ANIBES study', Nutrients, 10(7), 846. Available at:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6073544/ (Accessed: 9 July 2026).

National Center for Biotechnology Information (2023) *Biochemistry, iron absorption*. StatPearls. Available at: https://www.ncbi.nlm.nih.gov/books/NBK448204/ (Accessed: 9 July 2026).

National Center for Biotechnology Information (2024) *Biochemistry, essential amino acids*. StatPearls. Available at: https://www.ncbi.nlm.nih.gov/books/NBK557845/ (Accessed: 9 July 2026).

National Institutes of Health (2025a) *Vitamin B12: fact sheet for health professionals*. Office of Dietary Supplements. Available at: https://ods.od.nih.gov/factsheets/VitaminB12-HealthProfessional/ (Accessed: 9 July 2026).

National Institutes of Health (2025b) *Vitamin D: fact sheet for health professionals*. Office of Dietary Supplements. Available at: https://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/ (Accessed: 9 July 2026).

National Institutes of Health (2025c) *Vitamin K: fact sheet for health professionals*. Office of Dietary Supplements. Available at: https://ods.od.nih.gov/factsheets/VitaminK-HealthProfessional/ (Accessed: 9 July 2026).

National Institutes of Health (2025d) *Iodine: fact sheet for health professionals.* Office of Dietary Supplements. Available at: https://ods.od.nih.gov/factsheets/Iodine-HealthProfessional/ (Accessed: 9 July 2026).

National Institutes of Health (2025e) *Selenium: fact sheet for health professionals.* Office of Dietary Supplements. Available at:

https://ods.od.nih.gov/factsheets/Selenium-HealthProfessional/ (Accessed: 9 July 2026).

National Institutes of Health (2025f) *Zinc: fact sheet for health professionals.* Office of Dietary Supplements. Available at: https://ods.od.nih.gov/factsheets/Zinc-HealthProfessional/ (Accessed: 9 July 2026).

National Institutes of Health (2025g) *Manganese: fact sheet for health professionals.* Office of Dietary Supplements. Available at: https://ods.od.nih.gov/factsheets/Manganese-HealthProfessional/ (Accessed: 9 July 2026).

National Institutes of Health (2025h) *Magnesium: fact sheet for health professionals.* Office of Dietary Supplements. Available at: https://ods.od.nih.gov/factsheets/Magnesium-HealthProfessional/ (Accessed: 9 July 2026).

National Institutes of Health (2025i) *Copper: fact sheet for health professionals*. Office of Dietary Supplements. Available at: https://ods.od.nih.gov/factsheets/Copper-HealthProfessional/ (Accessed: 9 July 2026).

National Institutes of Health (2025j) *Calcium: fact sheet for health professionals*. Office of Dietary Supplements. Available at: https://ods.od.nih.gov/factsheets/Calcium-HealthProfessional/ (Accessed: 9 July 2026).

National Institutes of Health (2025k) *Phosphorus: fact sheet for health professionals*. Office of Dietary Supplements. Available at: https://ods.od.nih.gov/factsheets/Phosphorus-HealthProfessional/ (Accessed: 9 July 2026).

National Institutes of Health (2025l) *Potassium: fact sheet for health professionals*. Office of Dietary Supplements. Available at:

https://ods.od.nih.gov/factsheets/Potassium-HealthProfessional/ (Accessed: 9 July 2026).

National Institutes of Health (2025m) *Molybdenum: fact sheet for health professionals*. Office of Dietary Supplements. Available at: https://ods.od.nih.gov/factsheets/Molybdenum-HealthProfessional/ (Accessed: 9 July 2026).

National Institutes of Health (2025n) *Vitamin E: fact sheet for health professionals*. Office of Dietary Supplements. Available at: https://ods.od.nih.gov/factsheets/VitaminE-HealthProfessional/ (Accessed: 9 July 2026).

National Institutes of Health (2025o) *Folate: fact sheet for health professionals*. Office of Dietary Supplements. Available at: https://ods.od.nih.gov/factsheets/Folate-HealthProfessional/ (Accessed: 9 July 2026).

National Institutes of Health (2025p) *Choline: fact sheet for health professionals*. Office of Dietary Supplements. Available at: https://ods.od.nih.gov/factsheets/Choline-HealthProfessional/ (Accessed: 9 July 2026).

National Institutes of Health (2025q) *Vitamin C: fact sheet for health professionals*. Office of Dietary Supplements. Available at: https://ods.od.nih.gov/factsheets/VitaminC-HealthProfessional/ (Accessed: 9 July 2026).

National Research Council (1989) *Diet and health: implications for reducing chronic disease risk*. Washington, DC: National Academy Press. Available at: https://www.ncbi.nlm.nih.gov/books/NBK218749/ (Accessed: 9 July 2026).

Pinto-Junior, D.C., Silva, K.S., Michalani, M.L., Yonamine, C.Y., Esteves, J.V., Fabre, N.T., Thieme, K., Catanozi, S., Okamoto, M.M., Seraphim, P.M., Corrêa-Giannella, M.L., Passarelli, M. and Machado, U.F. (2018) ‘Advanced glycation end products-induced insulin resistance involves repression of skeletal muscle GLUT4 expression’, *Scientific Reports*, 8(1), 8109. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5970140/ (Accessed: 9 July 2026).

Tang, G. (2010) ‘Bioconversion of dietary provitamin A carotenoids to vitamin A in humans’, *American Journal of Clinical Nutrition*, 91(5), pp. 1468S–1473S. Available at: https://pubmed.ncbi.nlm.nih.gov/20200262/ (Accessed: 9 July 2026).

USDA FoodData Central (2024) *Potatoes, flesh and skin, raw*. Available at: https://fdc.nal.usda.gov/food-details/170028/nutrients (Accessed: 9 July 2026).

Volek, J.S., Yancy, W.S., Gower, B.A., Phinney, S.D., Slavin, J., Koutnik, A.P., Hurn, M., Spinner, J., Cucuzzella, M. and Hecht, F.M. (2024) ‘Expert consensus on nutrition and lower-carbohydrate diets: an evidence- and equity-based approach to dietary guidance’, *Frontiers in Nutrition*, 11, 1376098. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC10937533/ (Accessed: 9 July 2026).