

# NUTRITION & LONG-COVID

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LEADERS IN NUTRITIONAL MEDICINE



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[www.holisticperformance.institute](http://www.holisticperformance.institute)

# Background

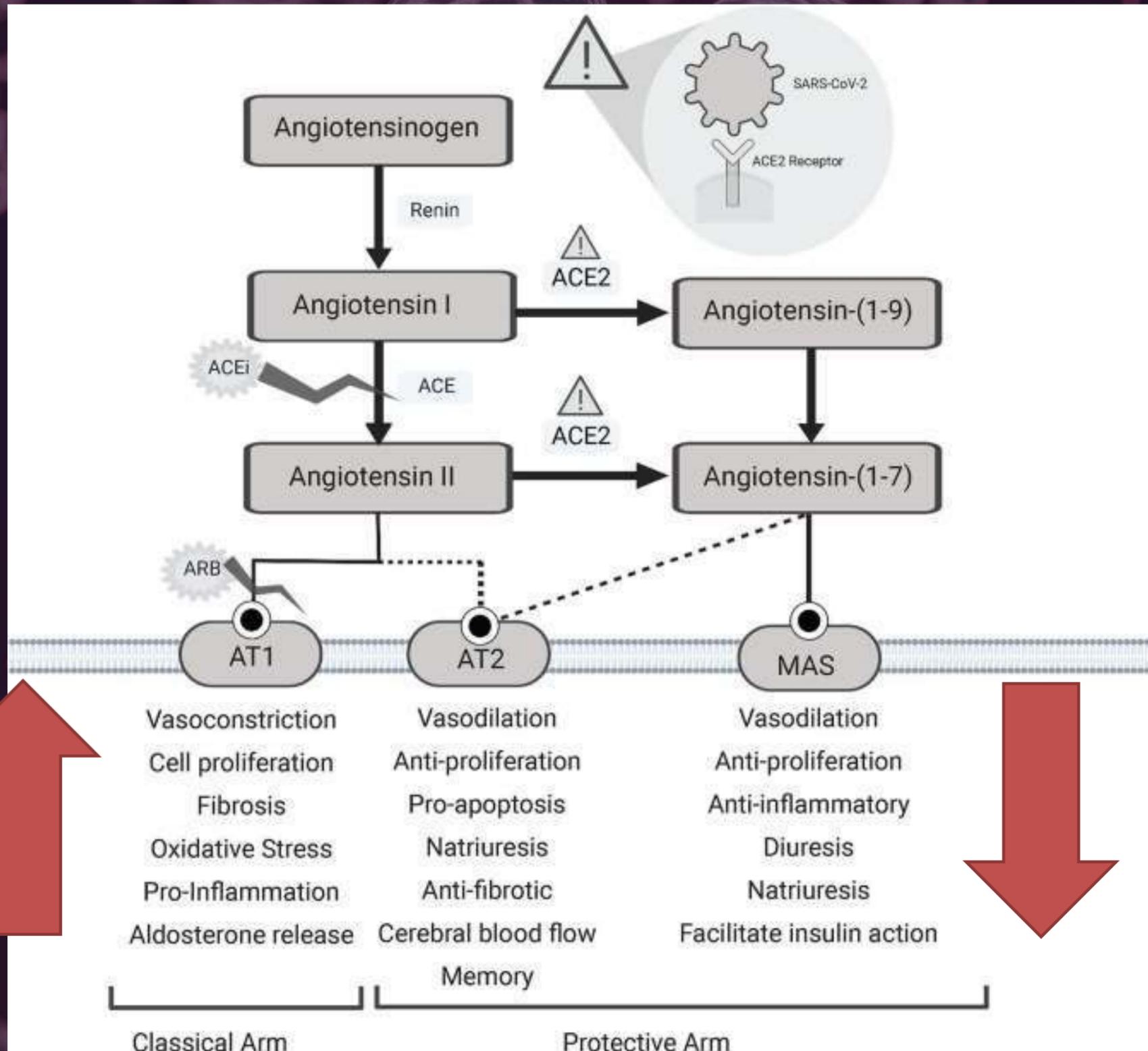
- Also known as post-COVID syndrome (PCS)
- Refers to symptoms lasting more than 3 months after diagnosis
- Symptoms include:
  - Fatigue (up to 72% of patients)
  - Shortness of breath (40%)
  - Cognitive effects (26%)
  - Loss of smell (22%)
  - Loss of taste (11%)
  - Muscle dysfunction and muscle-loss

# COVID and PCS Events have similar causes

PCS is thought to also result from a sequela of events involving multi-system inflammation mediated by immune dysfunction, like COVID-19 effects, albeit usually less severe and affecting people who may not have experienced severe symptoms of COVID-19 itself.

# Causes

- Direct damage (and resultant toxicity) to cells affected by the SARS-CoV-2 virus
- Ongoing (multi-system inflammation)
- Vascular injury and ischemia (especially as caused by blood clots)
- Impaired regulation of the renin-angiotensin system related to the effect of SARS-CoV-2 on ACE2 containing tissue
- Induced autoimmunity
- Persistent COVID infection



Wiese OJ, Allwood BW, Zemlin AE. COVID-19 and the renin-angiotensin system (RAS): A spark that sets the forest alight? Med Hypotheses. 2020 Nov;144:110231. doi: 10.1016/j.mehy.2020.110231. Epub 2020 Sep 3. PMID: 33254538; PMCID: PMC7468676.



# 35%

It is estimated that up to 35% of people infected with COVID will suffer PCS.

(Influenza <30%, EBV → mono 35-50%)



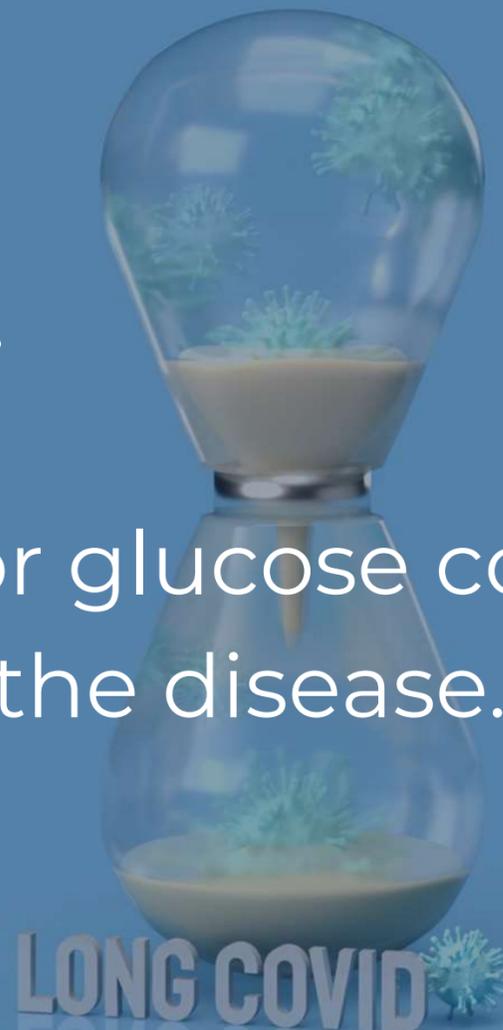
# 85%

Up to 85% of hospitalised patients may suffer PCS effects.

# Risk factors

- Age
- Obesity
- Metabolic syndrome
- *Nutrient insufficiency...*

Insulin resistance and poor glucose control are risk-factors for PCS  
BUT they also result from the disease.



LONG COVID

An iceberg floats on a calm, blue ocean under a clear sky. The visible part of the iceberg is a smooth, rounded peak. Below the waterline, a much larger and more intricate structure is visible, resembling a complex, crystalline or organic form. The text "What we don't see...." is overlaid on the left side of the image, emphasizing the hidden part of the iceberg.

**What we don't  
see....**



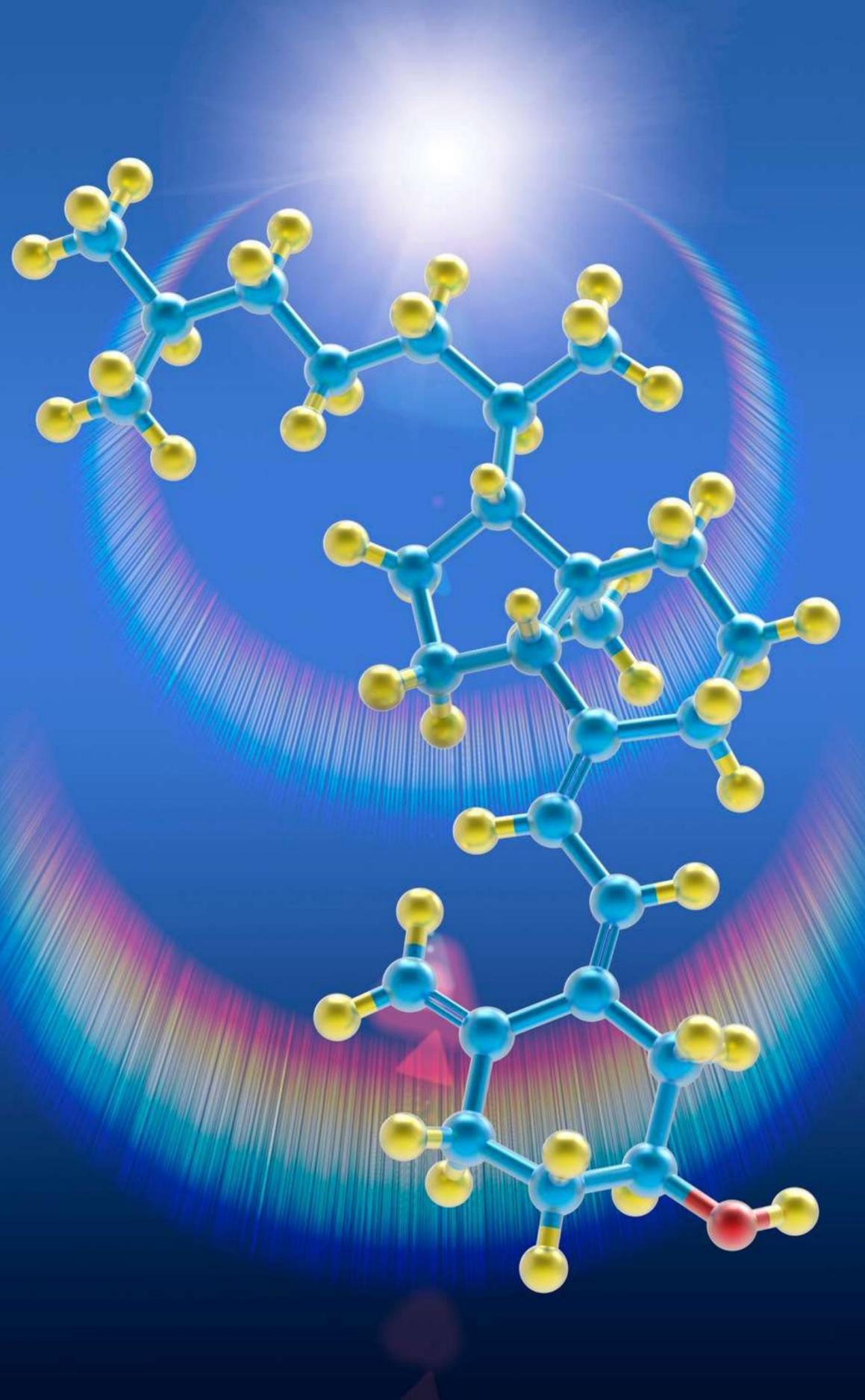
# 72%

Of PCS patients not meeting energy requirements



**56%**

not meeting protein requirements



# 45%

had insufficient vitamin D levels



**61%**

malnourished



# Post-COVID Syndrome and muscle dysfunction



# Anabolic resistance

Muscle dysfunction and loss result from 'anabolic resistance' related to PCS inflammation.



# Impaired folate-mediated one-carbon metabolism

Can be indicated by a high homocysteine reading.

Supplementation of B-vitamin complex can help address this (methylated forms of B9 and B12 recommended).



# Vitamin C

Vitamin C is known to reduce fatigue.

Most trials show benefits from IV  
vitamin C

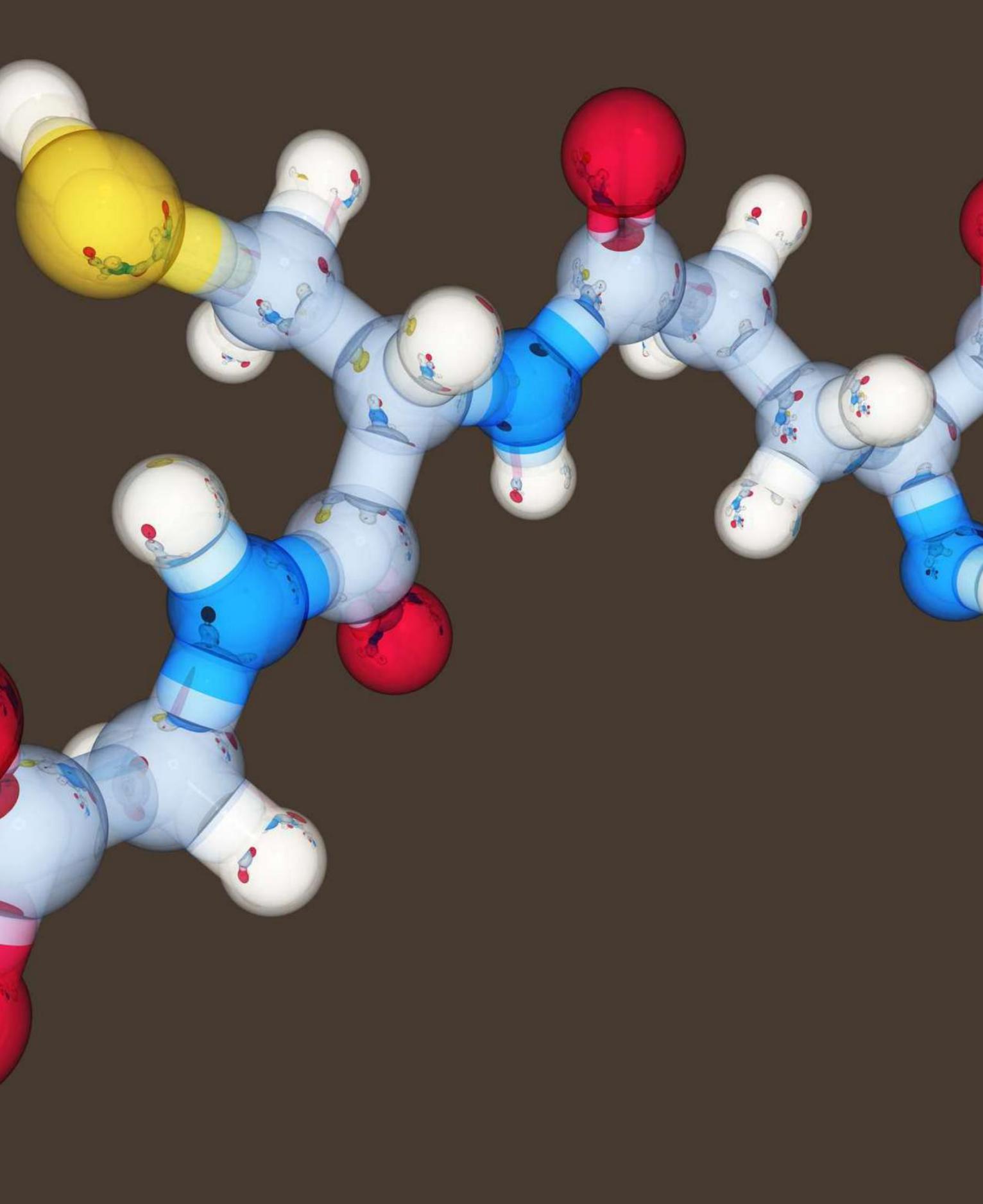
It is unclear whether high-dose oral  
supplementation will give similar  
benefits



# Vitamin D

Vitamin D deficiency is common in COVID survivors and PCS patients.

Vitamin D insufficiency is linked to poorer physical and mental performance in PCS.



# Glutathione

- The key antioxidant
- Reduces oxidation
- Reduces inflammation
- Inhibits viral replication

An endogenous 'deficiency' of glutathione could be a primary causative factor for severe COVID and mortality.

COVID-19 patients have lower glutathione levels than controls and there is a quantity-dependent relationship between GSH status and severity of COVID.

It is also likely to be involved in post-viral complications.



# N-Acetylcysteine

- Glutathione fails to enter the cell intact
- NAC is a better pro-drug for cysteine
- Other immune-related (AI) conditions benefit from 1200-2400 mg of NAC/day

NAC is the preferred cysteine-donor for glutathione production.

# Co-enzyme Q10



- Viruses require mitochondrial energy for replication
- CoQ10 is an integral part of mitochondrial ATP production
- CoQ10 'deficiency' is related to severe COVID disease, increased oxidation, and worsened viral inhibition
- As a supplement known to reduce fatigue, CoQ10 is recommended in the treatment of PCS.

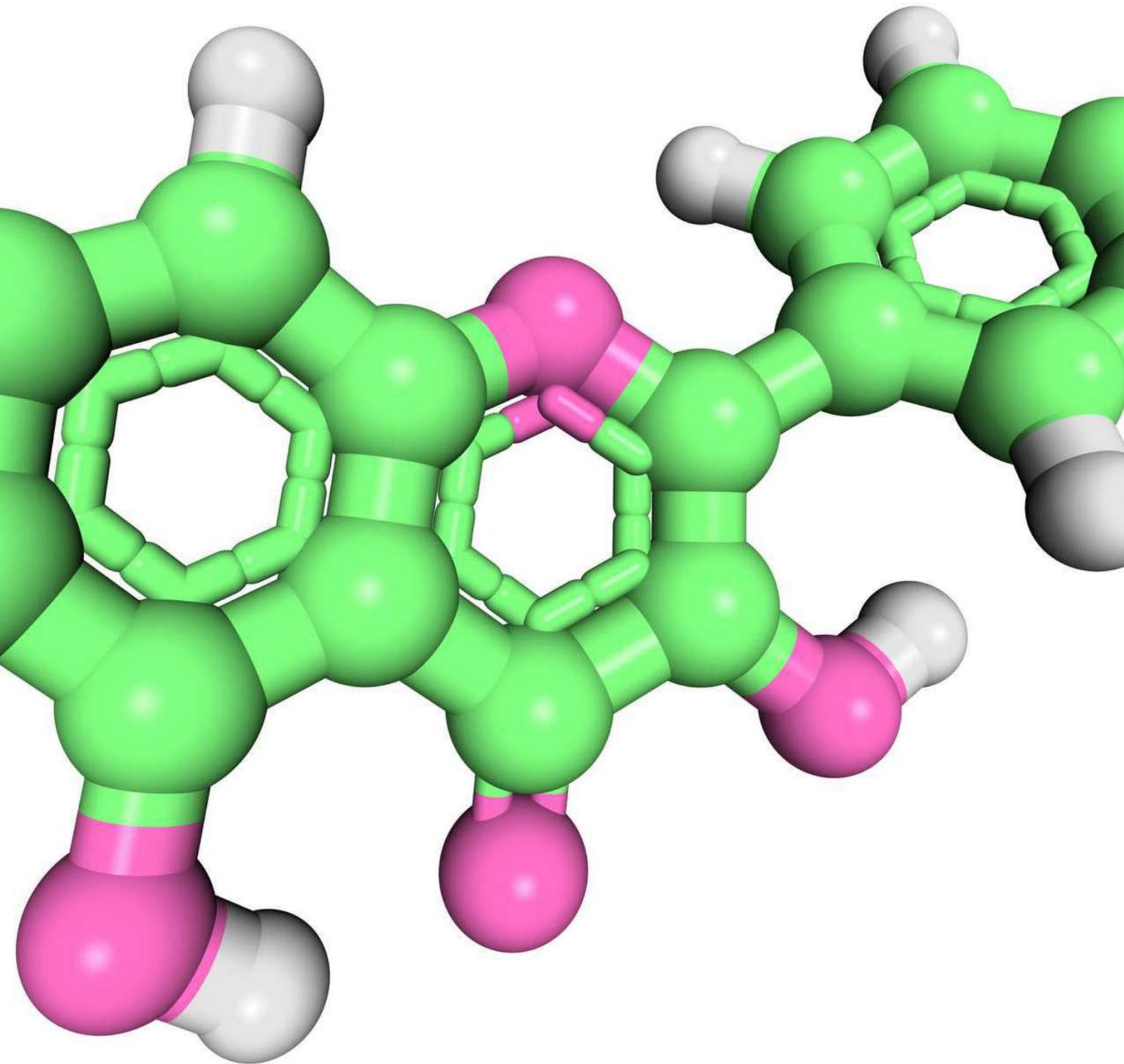
*Mitochondrial targeted CoQ10 is approximately 8 x more effective per dose due to improved cellular uptake.*

# NAD+ Boosters

- NAD+ is an integral part of energy production
- NAD+ depletion is implicated in COVID and post-viral complications
- NAD+ levels typically decline with age (and poorer health & met. status)

*Nicotinamide riboside reliably increases NAD+ levels.*





# Quercetin

- Suppresses the NLRP3 inflammasome
- Also inhibits viral replication

400-600 mg of quercetin per day has been shown to reduce inflammatory markers (ferritin, CRP) and improve COVID outcomes.

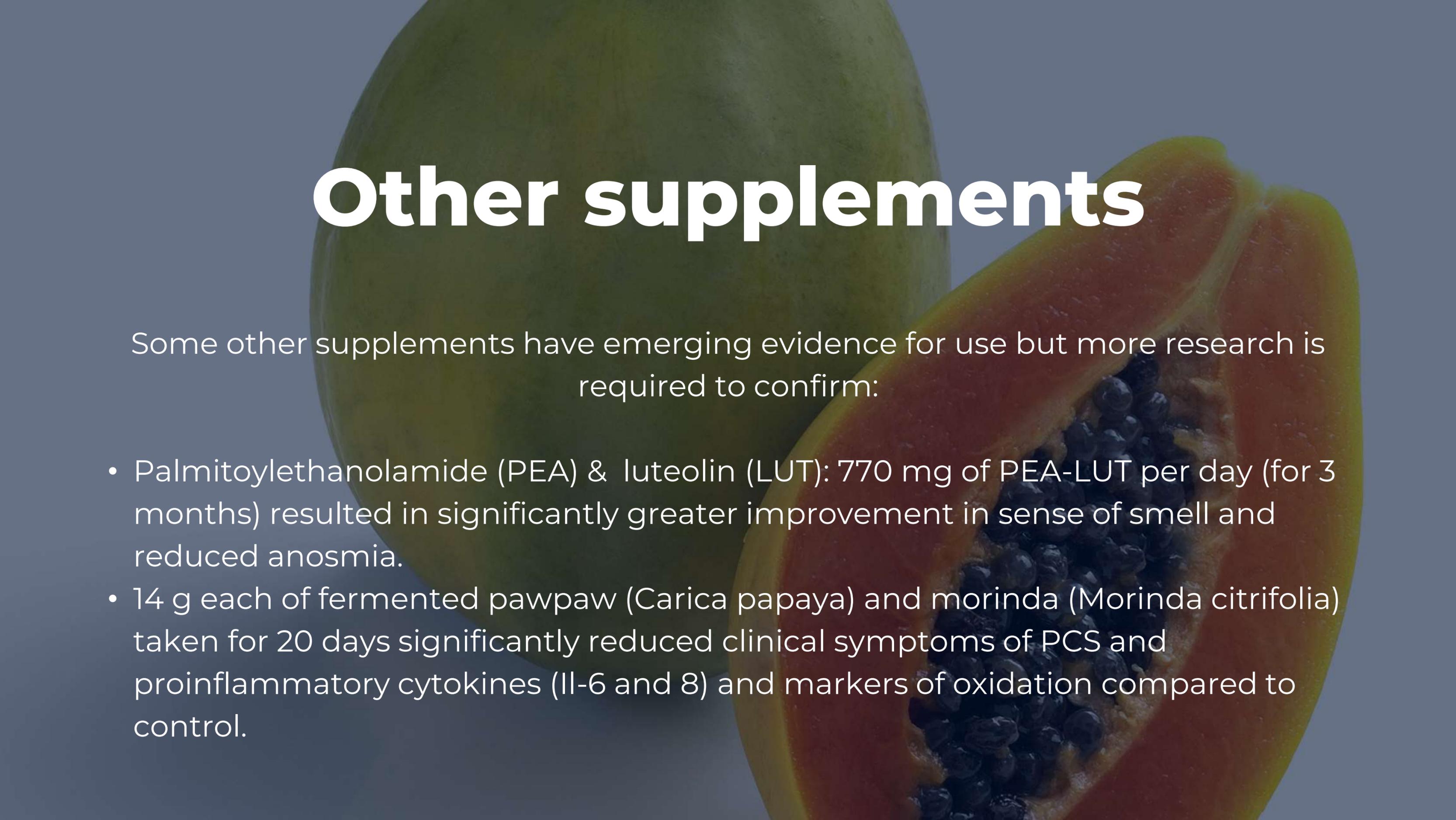
Also shown to reduce respiratory infection and be protective against COVID-induced kidney damage.

# A case for Lion's Mane?

Hericiium spp. have been shown to reduce inflammation, neuroinflammation, and encourage improved cognition and memory, reduce depression, and increase neuroplasticity and neurogenesis.

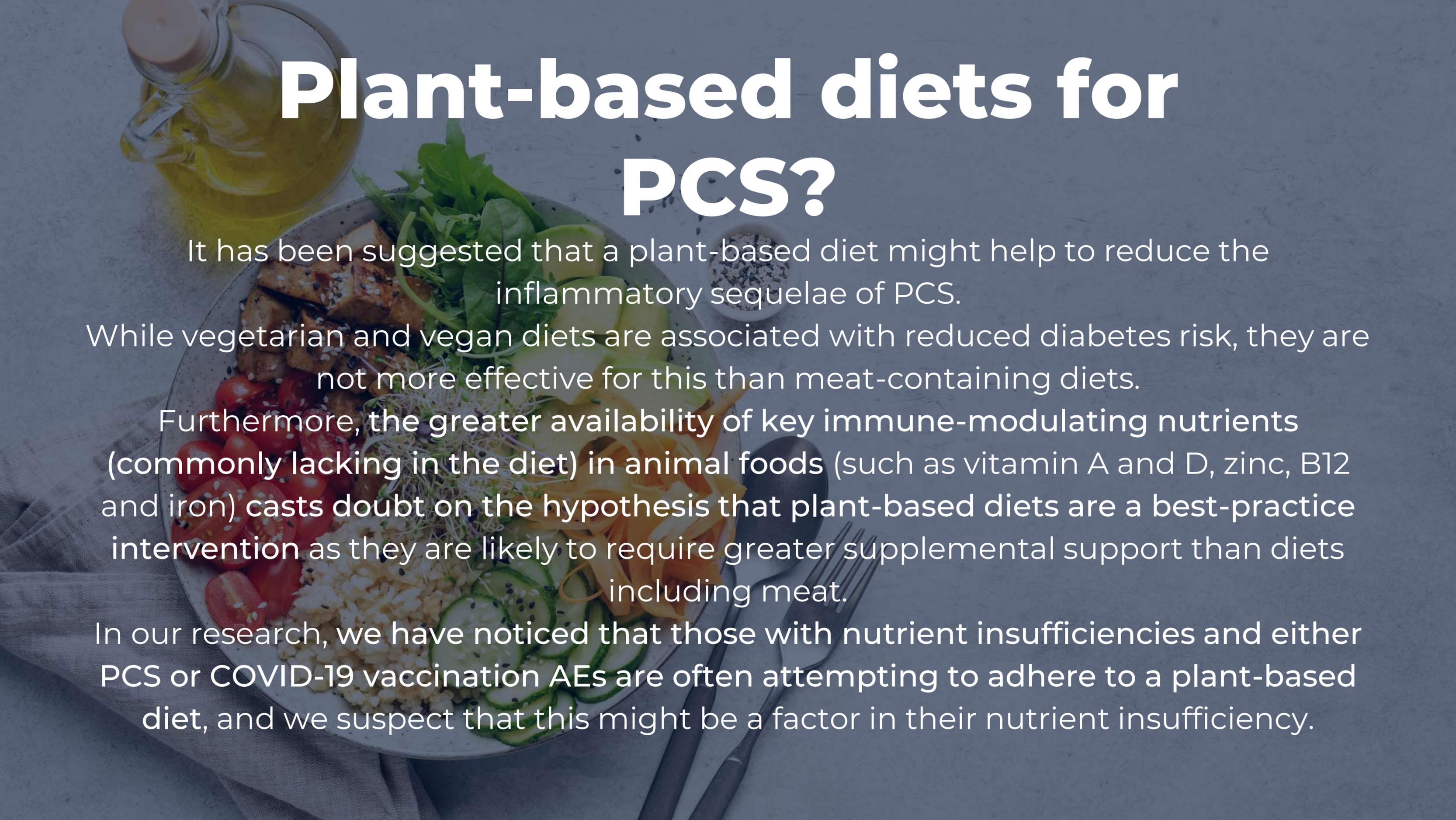
In our cases, Hericiium has resulted in drastic improvements in energy/fatigue and reduced neurocognitive effects.

# Other supplements



Some other supplements have emerging evidence for use but more research is required to confirm:

- Palmitoylethanolamide (PEA) & luteolin (LUT): 770 mg of PEA-LUT per day (for 3 months) resulted in significantly greater improvement in sense of smell and reduced anosmia.
- 14 g each of fermented pawpaw (*Carica papaya*) and morinda (*Morinda citrifolia*) taken for 20 days significantly reduced clinical symptoms of PCS and proinflammatory cytokines (IL-6 and 8) and markers of oxidation compared to control.

A top-down view of a healthy plant-based meal on a light-colored plate. The meal includes white rice, sliced cucumbers, cherry tomatoes, shredded carrots, and a piece of fried tofu. A small bowl of sesame seeds is next to the plate. A glass of yellow oil is in the top left corner. The background is a light-colored surface.

# Plant-based diets for PCS?

It has been suggested that a plant-based diet might help to reduce the inflammatory sequelae of PCS.

While vegetarian and vegan diets are associated with reduced diabetes risk, they are not more effective for this than meat-containing diets.

Furthermore, the greater availability of key immune-modulating nutrients (commonly lacking in the diet) in animal foods (such as vitamin A and D, zinc, B12 and iron) casts doubt on the hypothesis that plant-based diets are a best-practice intervention as they are likely to require greater supplemental support than diets including meat.

In our research, we have noticed that those with nutrient insufficiencies and either PCS or COVID-19 vaccination AEs are often attempting to adhere to a plant-based diet, and we suspect that this might be a factor in their nutrient insufficiency.

# RECOMMENDATIONS

Nutrition & lifestyle tactics for Post-COVID Syndrome





# Diet

Any energy, micronutrient, EFA, and protein-sufficient diet based on a compendium of mostly unrefined foods (lower in hyper-palatable ultra-refined foods) is likely to be a good option for both prevention and treatment of COVID-19 and PCS.

Note: Protein targets for treatment of COVID-19 have been observed to be at least 50% higher than the RDA: 1.2 to 2 g/kg/day



# Lifestyle

Stress, exercise, and sleep are all known immunomodulators. Sufficient sleep (duration and quality), exercise not leading to overtraining, and modulation of stress are all likely to improve COVID-19-related health outcomes.



# Exercise

- Exercise is 'tonic' for the immune system.
- It is imperative to include resistance training to offset anabolic resistance.
- Resistance training should initially be of a limited intensity (i.e., >3 RIR) and be performed for low repetitions and low volume.
  - I.e., 2 sets of 3-6 repetitions, 2-3 x per week.



# Priority Supplements

- Multinutrient providing DRI amounts of essential vitamins and minerals (esp. B-vitamins)
- Zinc: 8-30 mg/day to bring serum zinc levels to  $>10$   $\mu\text{mol/L}$
- Vitamin D:  $\sim 2000$  iu per day to return serum 25(OH)D to  $>125$  nmol/L
- Fish oil:  $>1000$  mg combined DHA/EPA
- Vitamin C:  $>1000$  mg per day



# Secondary supplements

- NAC 1200-2400 mg per day
- Lion's Mane equivalent to 1-3+ grams (powder)
- Nicotinamide riboside ~900 mg+
- Quercetin 400-600 mg
- Mitochondrial targeted CoQ10 10 mg+



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