Nutrition, COVID-19 Recovery and Vaccination

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Introduction

- Coronavirus is a pathogen that causes a wide range of symptoms, primarily respiratory
- COVID-19 sufferers can experience ongoing health challenges
- Increased age and/or preexisting health conditions such as obesity, diabetes, and lung disease can exacerbate risk

Intervention in Infectious disease

- Immune support*
- Antimicrobial or anti-infective treatment
- Symptomatic support
  - Acute symptoms
  - Effects on inflammation
  - Post-recovery symptoms

Nutrition and Immune Support

- Adequate nutrition supports the optimal functioning of the immune system
- Enhancement of immune system function and natural defenses most effectively allows the body to fight off infection
- Nutrition and lifestyle are key factors in preexisting conditions such as metabolic syndrome

Lifestyle and Immune System

- Moderate levels of exercise enhance immune function, but intensive training can impair function
- Psychological stress increases susceptibility to infections
- Increased social support is protective against upper respiratory infections
- Components of the typical Western diet can have an adverse effect on immunity, as well as affecting obesity, diabetes, and other conditions increasing vulnerability
  - Sugar
  - Saturated fat
  - Red meat
  - Salt

Lifestyle factors and Inflammation

- Obesity promotes low-grade inflammation
- Gut microflora can affect inflammation
- Regular exercise decreases inflammation
- Diet can play a role in chronic inflammation

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Diet and inflammation

Diet: Decreased inflammation

- Healthy diet: whole grains,
- Fruits and vegetables, fish
- Vitamin C
- Vitamin E
- Carotenoids
- Zinc
- Omega three fatty acids
- Magnesium
- Mediterranean diet

Diet: Increased inflammation

- Saturated and trans fat
- High glucose/high fat meals

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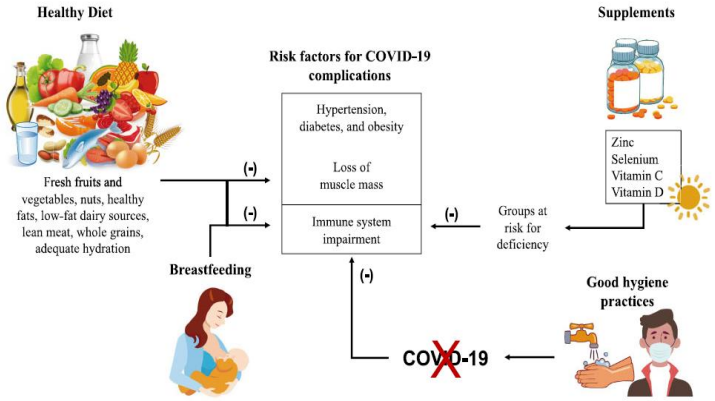
Rational for dietary recommendations in COVID-19



Dietary Supplements and COVID-19???

- In general, deficiency of a particular nutrient can clearly impair function
- The benefits of supplementation are less clear
- Consumption of nutrients in foods, especially as fruits and vegetables, is likely to provide the most benefit
- However, as nutritional adequacy could be affected by quarantine conditions, supplementation could be helpful

Dietary supplements and COVID infection

Micronutrients
- Vitamin A
- Vitamin C
- Vitamin D
- Zinc

Macronutrients
- Protein
- PUFAs

Other
- Probiotics
- Echinacea
- N-acetyl cysteine

Dramatic Increase in Dietary Supplement Use During Covid-19

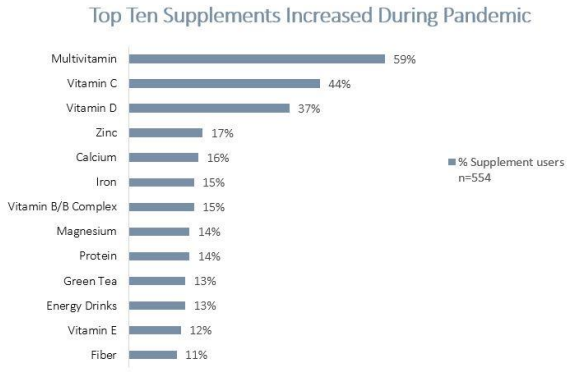
- Individual's dietary supplement use before and during the pandemic:

---- Asia: 29.5% and 71.9%

---- America: 40.6% and 75.7%

---- Europe: 30.8% and 68.7%

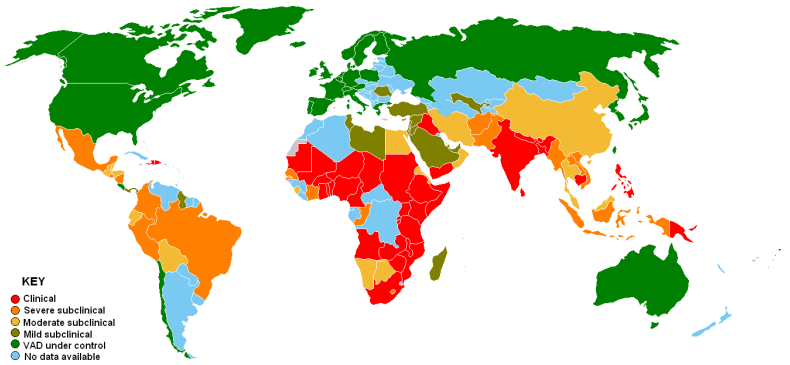
---- Turkey 21.3% and 62.2%



Vitamin A:

- Enhances innate immunity
  - Needed for mucosal membrane integrity and function in producing mucus and clearing pathogens
- Binds nuclear receptor that alters transcription of immune-related genes
  - Increases regulatory T-cells
  - Increases IgA production
- Also alters immunoglobulin secretion in breast milk
- Present in foods as vitamin A and as the precursor beta-carotene

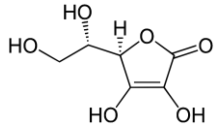
Global distribution of vitamin A deficiency



Vitamin A and COVID-19

- Prevention of vitamin A deficiency is likely helpful
- Benefits suggested for COVID via effects on type 1 interferons
- Note that vitamin A toxicity is a concern, especially in pregnancy, but beta carotenes do not have this risk

Vitamin C



- Needed for immune function
  - May increase phagocyte and lymphocyte function
  - Has antioxidant effect
- Widely used for common cold
  - May shorten duration of common cold
  - May be more effective in individuals with physical stress, children
  - Does not appear to be protective for cold prevention
- Also has antioxidant effects

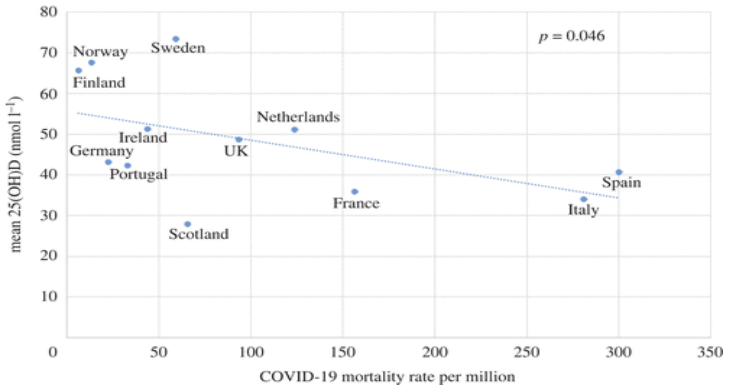
Vitamin C and COVID

- Vitamin C deficiency impairs immune function, so vitamin C adequacy is important
- There is interest in supplemental Vitamin C for COVID due to its use for the common cold
- Searching the National Institutes of Health ClinicalTrials.gov website for “COVID” and “vitamin C" yielded twenty-one randomized controlled trials for COVID and vitamin C alone or in combination as treatment
  - The majority of these trials are in early stages
- High doses of vitamin C are widely used with relative safety, although increased risk of kidney stones is a possible consequence

Vitamin D

- Most known for its effects on calcium regulation and maintenance of bone strength
- However, receptors are found on many other cells in the body, including the immune system
- Low vitamin D could predispose to respiratory infections
  - Supplementation could help in cases of severe vitamin D deficiency

Ecologic study on vitamin D levels and COVID-19 mortality

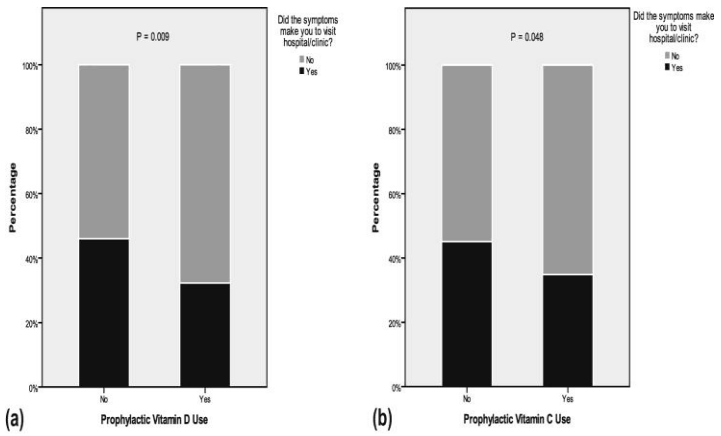


Case-control study on serum micronutrients and COVID-19

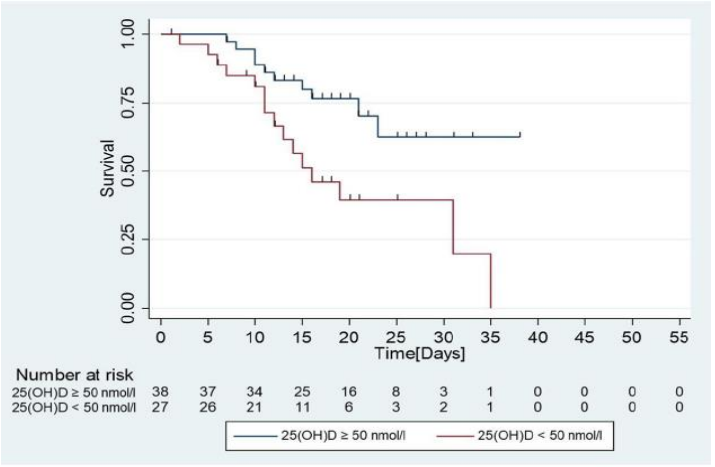
Serum vitamin D, calcium, and Zinc levels in the case and control groups.

Serum levels (reference range)	Case	control	p-value t-test
Vitamin D (30–100 ng/ml)	22.83 ± 12.97	27.50 ± 15.35	.008
Calcium (8.6–10.3 mg/dl)	9.14 ± .39	9.50 ± .52	<.001
Zinc (70–127 µg/dl)	67.61 ± 15.10	86.66 ± 11.76	<.001

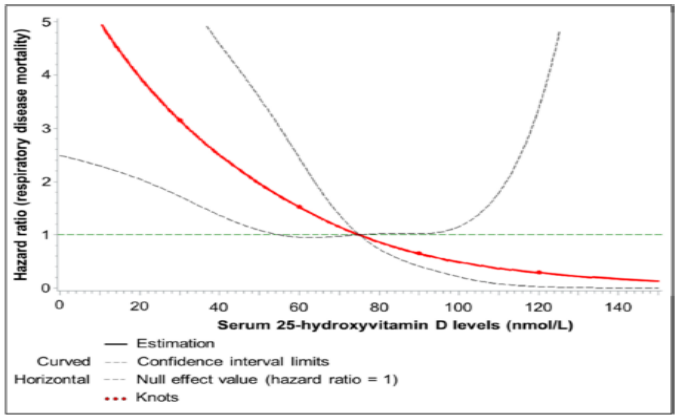
The proportion of hospital visit in patients with or without the use of prophylactic vitamin D (a) and vitamin C (b).



Kaplan–Meier survival analysis according to 25(OH)D levels in men with COVID-19



Dose–response relationship between 25(OH)D levels and respiratory disease mortality.



Zinc

- Essential mineral used as a cofactor for multiple enzymes, considered antioxidant
- Deficiency produces a number of adverse effects on growth, immune function, and cognition
- Used topically and orally for multiple purposes
- Commonly used for decreasing severity and duration of common cold but evidence is conflicting
- Might decrease incidence of pneumonia in undernourished children
- Elderly might be more likely to be zinc-deficient

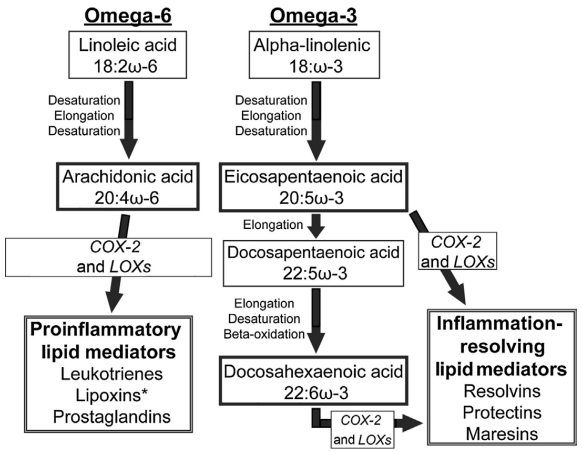
Protein

- Protein deficiency is known to impair immune function, particularly immunoglobulins and gut-associated lymphoid tissue
- Specific amino acids such as arginine and glutamine plays a particularly important role in immune cell function
- Protein deficiency has been associated with increased viral susceptibility and decreased response to influenza vaccination
- High quality protein is of course important for general health

Omega-3 fatty acids

- Omega-3 fatty acids are essential dietary components
- Can also modulate the inflammatory cascade by serving as precursors to anti-inflammatory mediators

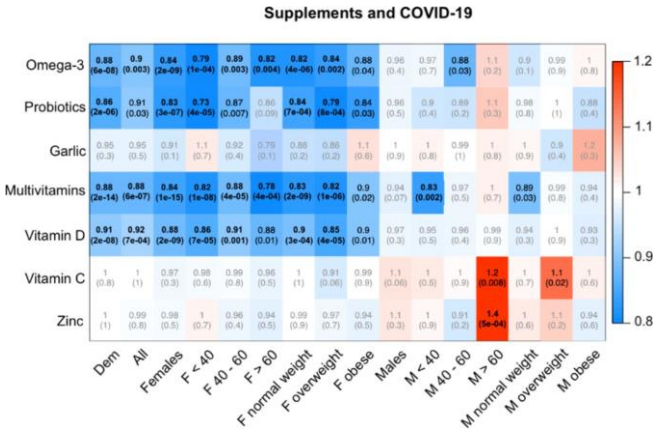
Omega-3 fatty acid: Effects on inflammation



Omega-3 fatty acid and COVID

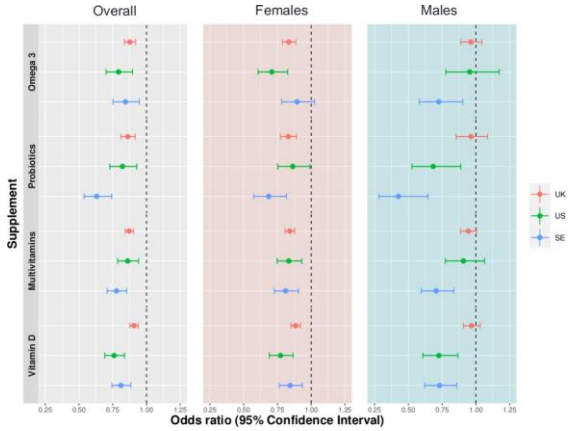
- Omega-3 fatty acid supplementation, in particular the fish oils DHA and EPA, has been suggested as having a benefit in cytokine storm
  - Oral, enteral, and intravenous lipid emulsions are possible dosage forms
- The cardiovascular benefits of omega-3 fatty acids could also play a role in decreasing risk factors and mitigating chronic sequelae of COVID
  - E.g., Deep vein thrombosis
- ClinicalTrials.gov lists seven trials containing omega-3 fatty acids, three with the prescription EPA product icosopent ethyl

Associations between testing positive for SARS-CoV-2 and self-reported use of supplements in UK app users.



Panayiotis Louca et al. BMJNPH 2021;4:149-157

ORs and 95% CIs for the associations between testing positive for SARS-CoV-2 and self-reported use of supplements in three cohorts (n=372 720 UK, n=45 575 USA and n=27 373 SE).



Probiotics

- Probiotics have traditionally been used in treating various forms of infectious diarrhea
- Less directly, the immune system can be affected by altering gut microflora
  - Alters immune regulation
  - Alters intestinal permeability (leaky gut)
- Effects depend greatly on the type, amount, and viability of the probiotic being used

Probiotics

- *Prebiotics* make the gut more welcoming for probiotic growth
  - Prebiotics such as fiber have shown beneficial effects
  - For example, both probiotics and prebiotics have demonstrated increases in the effectiveness of influenza vaccine
- Increased prebiotic effects could contribute to the health benefits of whole grains, legumes, and other plant products

Probiotics and COVID

- A number of studies demonstrate benefits of specific probiotic products for respiratory tract infections though not for COVID specifically
- Benefits are likely to depend on the use of specific strains and not common probiotics available commercially
- Relatively safe although possible risk of infection in immunocompromised patients

Conclusion

- Zinc supplements might shorten smell recovery, without influencing the complete recovery duration from COVID-19. There is currently limited evidence to suggest zinc supplementation has any beneficial effects against the current novel COVID-19.

-Vitamin D3 did not significantly reduce patient hospitalization time, mortality, admission to the intensive care unit, or need of mechanical ventilation in moderate to severe cases of COVID-19

- Despite therapeutic effect of n-3 fatty acids against ARDS in humans, there is still limited evidence of their effectiveness on COVID-19.

Conclusion

-With regard to vitamin C, the majority of studies investigate the intravenous infusion of vitamin C in severe patients. The potential prophylactic administration of vitamin C via oral supplementation for healthy individuals or potentially asymptomatic patients needs further evidence.

- Despite widespread prevalence of vitamin D deficiency, there is insufficient data to recommend either for or against the use of vitamin D for the prevention or treatment of COVID-19.

Conclusion

Despite convincing evidence about potential therapeutic value of probiotics in respiratory infections, data for COVID-19 are still scarce.

Dietary Fiber and Carbs

Consumption of carbohydrates with higher glycemic indices (highly processed carbs) can lead to mitochondrial overload and subsequent free radical production.

Dietary Fiber and Carbs

Consumption of these carbs has been linked to an increase in the levels of inflammatory cytokines in the blood.

Fiber consumption of 25–35 grams per day may aid in the reduction of both systemic and intestinal inflammation.

Dietary Fiber and Carbs

Consumption of **fiber-rich meals** has been linked to reduced levels of inflammatory cytokines (CRP, TNF-alpha, and IL-6), as well as higher levels of short-chain fatty acids (SCFAs)

Protein High Biological Value

Protein deficiency has been linked to a reduction in immune system function because it reduces the quantity of functional immunoglobulins and the amount of gut-associated lymphoid tissue (GALT)

Rehabiliation

protein intake of **>1 g/kg/day (up to 1.5 g/kg/day)**

carbohydrate and lipid requirements: based on the non-protein energy **30:70** in patients with no respiratory insufficiency and **50:50** in patients with respiratory insufficiency.

- Maintaining an adequate hydration of the patient
- In this regard, the clinical history of the patient (heart or renal failure, vomiting or diarrhea) must be analyzed.

Nutrition and Vaccination

An effective immune response requires an adequate host nutritional status:

-Malnutrition
-Sufficient protein intake
-Hydration
-Sufficient intake of trace elements such as Vitamins C and D, zinc, and omega-3 fatty acids
-Anti-inflammatory foods
-Breakfast consumption
-Ginger
-Dietary Supplements: vitamins C, D and E together with Zn and Se are needed by the immune system in excess of amounts that can usually be achieved through diet alone

Thank you for your attention…

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