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# B12 Repletion Protocol

## Causes of deficiency

- Inadequate intake (common in vegetarians and vegans)
- Intestinal malabsorption
- Pernicious anemia – autoimmune condition that leads to destruction of intrinsic factor (IF)-producing parietal cells, or antibodies to IF itself.
  - Affects 2 percent of people over 60 years old.
- Atrophic gastritis – often caused by H. pylori infection in the elderly.
  - Affects 10 to 30 percent of people over 60 years old.
- Pancreatic enzyme insufficiency
- Alcoholism – reduces absorption of B12 in the terminal Ileum

## Who's at risk for deficiency?

- Vegetarians and vegans (B12 is only found in animal products)
- Elderly
- Patients with long-term use of proton pump inhibitors
- Patients with digestive disorders that lead to malabsorption
  - Disorders associated with low stomach acid, celiac disease, Crohn's disease, SIBO, and other GI conditions
- Women with frequent miscarriages or infertility (this suggests likely B12 deficiency but the cause still must be investigated)
- Those with genetic polymorphisms affecting B12 assimilation and metabolism
- Patients with long-term use of metformin

## Symptoms of B12 deficiency

- Weakness
- Fatigue
- Strange sensations
- Numbness, or tingling in the hands, legs, or feet
- Difficulty walking (staggering, balance problems)
- A swollen, inflamed tongue
- Yellowed skin (jaundice)
- Difficulty thinking and reasoning (cognitive difficulties), or memory loss
- Rarely paranoia or hallucinations may be seen in severe cases
- More advanced cases will present as anemia with associated symptoms. Of note, B12 or folate deficiency anemia is associated with macrocytosis, or large red blood cells measured as a high mean corpuscular volume (MCV)

### Recommended daily intake

- For people with normal absorption, we recommend daily intake of 17.6 mcg, which was the daily intake of our hunter gatherer ancestors.
- For people with impaired absorption, we recommend increasing daily intake to 150 to 200 mcg. This will likely require supplementation.

### Foods highest in B12

FOOD	AMOUNT (mcg per 100g)
Clam	99
Lamb liver	90
Beef liver	83
Duck liver	54
Oyster	35
Pork liver	26
Caviar	20
Mackerel	19

FOOD	AMOUNT (mcg per 100g)
Herring	19
Chicken liver	17
Mussel	12
Crab	11
Sardine	9
Salmon	6

- Muscle meats contain B12, but significantly less than organ meats.
- Plant foods do not contain true B12, but rather contain cobamides that block absorption of B12. This is why vegetarians and vegans must supplement to obtain adequate B12.

### Supplementing with B12

- B12 supplements should ideally contain all three forms of natural B12 (methylcobalamin, adenosylcobalamin, and hydroxycobalamin), and not contain cyanocobalamin, a synthetic form of B12.
- Betaine HCl may be added to increase absorption since it increases stomach acid (only in the absence of gastric ulcers and if not taking NSAIDs).
- Ask your clinician to re-test your B12 levels after 60 days of supplementation to confirm that your levels are improving. Treatment ranges from two months to ongoing depending on the cause of deficiency (e.g., patients with pernicious anemia will likely need to supplement for life).