10.22 Vitamin B$_{12}$ Deficiency & Toxicity

There are 2 primary symptoms of vitamin B$_{12}$ deficiency:

Megaloblastic (Macrocytic) Anemia
Neurological Abnormalities

**Megaloblastic (Macrocytic) Anemia**

This is the same type of anemia that occurs in folate deficiency that is characterized by fewer, enlarged, immature red blood cells. When a product of a vitamin B$_{12}$ deficiency, this occurs because there is not enough cobalamin to convert 5-methyl THF to THF (illustrated in Figure 10.211). Thus, THF is not available for normal DNA synthesis and the red blood cells do not divide correctly.

**Neurological Abnormalities**

Vitamin B$_{12}$ deficiency also results in nerve degeneration and abnormalities that can often precede the development of anemia. These include a decline in mental function and burning, tingling, and numbness of legs. These symptoms can continue to worsen and deficiency can be fatal$^1$.

The most common cause of vitamin B$_{12}$ deficiency is pernicious anemia, a condition of inadequate intrinsic factor production that causes poor vitamin B$_{12}$ absorption. This condition is common in people over the age of 50 because they have the condition atrophic gastritis$^2$. Atrophic gastritis is a chronic inflammatory condition that leads to the loss of glands in the stomach, as shown in the figure in the following link.

**Web Link**

[Atrophic Gastritis](#)

The loss of glands leads to decreased intrinsic factor production. It is estimated that $\sim$6% of those age 60 and over are vitamin B$_{12}$ deficient, with 20% having marginal status$^3$. In addition to the elderly, vegans are also at risk for vitamin B$_{12}$ deficiency because they do not consume animal products. However, the deficiency may take years to develop in adults because of stores and recycling of vitamin B$_{12}$$^2$. Deficiency has the potential to occur much quicker in infants or young children on vegan diets because they do not have stores that adults do$^4$.

**Folate/Folic Acid masking vitamin B$_{12}$ deficiency**

As mentioned above, folate and vitamin B$_{12}$ lead to the same megaloblastic (macrocytic) anemia. If folate or folic acid is given during vitamin B$_{12}$ deficiency, it can correct this anemia. This is referred to as masking because it does not rectify the deficiency, but it "cures" this
symptom. This is problematic because it does not correct the more serious neurological problems that can result from vitamin B$_{12}$ deficiency. There are some people who are concerned about the fortification of cereals and grains with folic acid because people who are B$_{12}$ deficient might not develop macrocytic anemia, which makes a vitamin B$_{12}$ deficiency harder to diagnose$^2$.

No toxicity of vitamin B$_{12}$ has been reported.

References & Links

Links