**Riboflavin (Vitamin B<sub>2</sub>)**

1. **What is the nutrient?**

Riboflavin is a crucial component of coenzymes that are involved in oxidation-reduction reactions occurring within the energy-producing metabolic pathways. These coenzymes, flavin mononucleotide (FMN) and flavin adenine dinucleotide (FAD) are involved in the metabolism of carbohydrates and fat. Vitamin B<sub>2</sub> is also part of the antioxidant enzyme glutathione peroxidase, thus assisting in the fight against oxidative damage.

Riboflavin is a water soluble vitamin which means it is not stored in the body. It must be replenished every day. Riboflavin is an important for body growth and red blood cell production. It also aids in releasing energy from carbohydrates. Riboflavin is yellow in color and is used as a food dye and it is used to fortify foods.

<table>
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<th>Nutrient</th>
<th>Function</th>
<th>Recommended Intake</th>
<th>Toxicity Symptoms</th>
<th>Deficiency Symptoms</th>
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<tr>
<td>RIBOFLAVIN</td>
<td>Conenzymes including FMN and FAD involved in oxidation-reduction reactions for metabolism of CHO and fats.</td>
<td>RDA for 19 years and older. Men = 1.3 mg/day Women = 1.1 mg/day</td>
<td>None Known at this time</td>
<td>Arriboflavins, cheilosis (dry cracked lips), angular stomatitis (inflammation of the mucous membranes of the mouth) seborrheic dermatitis</td>
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2. **What is the RDA/DRI for the nutrient?**

RDA:

**Infants**
- 0 - 6 months: 0.3 milligrams per day (mg/day)
- 7 - 12 months: 0.4 mg/day

**Children**
- 1 - 3 years: 0.5 mg/day
- 4 - 8 years: 0.6 mg/day
- 9 - 13 years: 0.9 mg/day
Adolescents and Adults
Males age 14 and older: 1.3 mg/day
Females age 14 to 18 years: 1.0 mg/day
Females age 19 and older: 1.1 mg/day

DRI→ not available. Follow RDA.

3. How is the nutrient metabolized?
Riboflavin is metabolized to form the flavin coenzymes; flavin adenine dinucleotide (FAD) and flavin mononucleotide (FMN).

4. What are the food sources of riboflavin?
Fortified grains and cereals, lean meats, eggs, legumes, nuts, green leafy vegetables, dairy products and milk. However, riboflavin is destroyed when it is exposed to light. Thus, milk is generally stored in opaque containers to prevent the destruction of riboflavin. Vegetables such as broccoli, asparagus, and spinach are the primary green sources. Three ounces of beef liver provides more than 100% of both men and women’s requirements of riboflavin.

5. What disease states alter the nutrients metabolism?
Conditions that affect absorption in the intestine alter the metabolism of riboflavin. Alcoholics are at increased risk for riboflavin deficiency due to decreased intake, decrease absorption, and impaired utilization of riboflavin. Anorexic individuals rarely consume adequate riboflavin and lactose intolerant individuals may not consume milk or other dairy products which are good sources of riboflavin. Hypothyroidism and adrenal insufficiency also alter the metabolism of the nutrient. Those who are highly active may have a slightly increased riboflavin requirement.

6. What are the tests or procedures to assess the nutrient level in the body?
Erythrocyte glutathione reductase activity. Glutathione reductase is a nicotinamide adenine dinucleotide phosphate (NADPH) a FAD-dependent enzyme, and the major flavoproteins in erythrocyte. It provides a measure of tissue saturation and long term riboflavin status.

Urinary riboflavin excretion: urinary riboflavin excretion rates increase slowly with increasing intakes.

7. What is the drug-nutrient interactions?
Several early reports indicated that women taking high-dose oral contraceptives (OC) had diminished riboflavin nutritional status. However, when investigators controlled for dietary riboflavin intake, no differences between OC users and non-users were found. Phenothiazine derivatives such as anti-psychotic medication chlorpromazine and tricyclic antidepressants inhibit the incorporation of riboflavin into FAD and FMN, as do the anti-malarial medication, quinacrine, and the cancer chemotherapy agent,
adriamycin. Long-term use of the anti-convulsant, phenobarbitol may increase destruction of riboflavin, by liver enzymes, increasing the risk of deficiency. (lpi.oregonstate.edu)

8. **How is the nutrient measured?**

In laboratory, fluorescence spectroscopy determines the mass of riboflavin in vitamin pills because the nutrient is extremely sensitive to its environment.

RDA’s for riboflavin is measure in micrograms.

The amount in the body is measured by urinary excretion.

9. **What is the upper tolerable limits?**

Upper tolerable limits are not established because it is so rare. However, cases of diarrhea and polyurea in patients on 400 mg/day for migraines have been reported.

10. **What are the physical signs of deficiency?**

Ariboflavinosis is the specific name given to riboflavin deficiency. The lack of riboflavin has profound effects on energy production, which result in nondescript symptoms such as fatigue and muscle weakness. Advanced deficiency can result in lips that are dry and scaly, inflammation and ulcers of the mucous membranes of the mouth and throat, irritated patches on the skin, changes in the cornea, anemia, and in some cases even personality changes. In addition, riboflavin is important in the metabolism of four other vitamins: folic acid, vitamin B6, vitamin K, and niacin. Thus, a deficiency in riboflavin can affect a number of the body’s systems. However, deficiency is not common because this vitamin is plentiful in the food supply.

11. **What are physical signs of toxicity?**

Riboflavin is not toxic when taken orally. Its low solubility keeps it from being absorbed in dangerous amounts from the gut. It is excreted in the urine.