CLINICAL VIGNETTE

What is the Evidence for Biotin?

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In our women's health practice, a number of women report using biotin to prevent hair loss and improve the quality of their skin and nails. These products have been endorsed by the lay press as well as internists and dermatologists.

What is it?

Biotin is a water soluble vitamin that belongs to the "B complex vitamins." It has also been referred to as Vitamin H. Biotin is naturally found in many foods including egg yolks, organ meats (liver, kidney), nuts (almonds, peanuts, pecans, and walnuts), soy beans, whole grains, cauliflowers, bananas, cheeses (especially blue cheese), mushrooms, sweet potatoes, and spinach. Raw or less-processed versions of these food contain more active biotin. Biotin is available in a variety of forms, including powders, gummies, capsule or liquid extracts, and these are often advertised to promote stronger hair, skin and nails.

Biotin Deficiency

Biotin deficiency is rare because it is present in many common foods. Biotin deficiency has been reported in several situations. 1) Biotin deficiency developed in patients requiring prolonged parenteral nutrition in which biotin was left off the formula. 2) Chronic intake of a large number of raw eggs can lead to biotin deficiency over many months. A protein in egg white, avidin tightly bind to biotin and can prevent digestive release of biotin. Because avidin is destroyed during cooking, chronic ingestion of uncooked eggs is needed.[1] 3) Rare genetic deficiency in biotinidase. 4) Patients receiving chronic antibiotics. 5) Patients with short bowel syndrome and malabsorption. 6) Leiner's disease, a rare disorder affecting the skin of infants, similar to severe seborrheic dermatitis which can result in erythroderma, increasing likelihood of infections. 7) Insufficient levels of biotin also noted in pregnancy, alcoholism, smoking, inflammatory bowel disease, and children with severe burns.

Clinical Presentation

Typical symptoms in biotin deficiency are skin and hair changes, including dry skin, seborrheic dermatitis, fungal infections, skin rashes, brittle hair, and alopecia. However hyperglycemia and neurologic abnormalities including depression, altered mental status, myalgias, hyperesthesias, paresthesias, coma and death have also been reported.[2] Biotinidase deficiency occurs in about 1 in 40,000 infants and results in a rash around the eyebrows and cheeks and neurological symp-toms, such as muscle pain, extreme tiredness, and numbness.

Interference with Laboratory Testing

The FDA issued a safety communication in 2017 regarding biotin interfering with lab tests. Many labs rely on biotin technology due to its ability to bond with a number of specific proteins which can be measured to diagnose a number of conditions. Biotin can lead to false positive or false negative results. Patients ingesting high levels of biotin in dietary supplements can have significant alteration in test results. The FDA has seen an increase in the number of adverse events reported, including one death.

An updated FDA safety alert was released in November 2019 regarding high biotin consumption interfering with cardiac biomarkers. This has resulted in falsely low troponin values which may lead to missed diagnoses with clinical complications.[3] At UCLA, the thyroid stimulating hormone test result, (TSH) includes a statement, "Ingestion of high levels of biotin in dietary supplements may lead to falsely decreased results." Hypothyroid patients consuming large amounts of biotin may have falsely decreased TSH results missing the diagnosis of hypothyroidism.

Dietary supplements promoted for hair, skin, and nail benefits may contain biotin levels up to 650 times the recommended daily intake. While many physicians are now aware of the biotin interference, they may not routinely ask patients exactly how much they are taking. Because biotin is a vitamin, patients may not report use during medication reconciliation.

Efficacy

Effectiveness of biotin supplementation ranges from likely effective to insufficient evidence to rare effectiveness. Administering biotin to patients with low levels may help relieve some biotin deficiency symptoms. Infants with seborrheic dermatitis have not reported improvement with biotin supplementation. For other symptoms including hair loss, brittle fingernails and toenails, diabetes, peripheral neuropathy, muscle cramps related to dialysis, and multiple sclerosis have insufficient evidence to support biotin effectiveness.

Biotin is likely safe, especially for most adults, who take it orally or apply topically in small amounts. High dose biotin has

been helpful in certain neurological conditions (e.g. multiple sclerosis) although the mechanism of action is unknown.

Treatment

A low pharmacologic dose of biotin by mouth will typically resolve the symptoms. As the average daily recommended amount for an adult is 30 mcg, some over the counter supplements contain up to 20 mg of biotin, and physicians treating multiple sclerosis have advised up to 300 mg per day.

- **General**: There is no recommended dietary allowance (RDA) established for biotin. The adequate intakes (AI) for biotin are 30 mcg for adults over 18 years and pregnant women, and 35 mcg for breast-feeding women.
- **Biotin deficiency**: Up to 10 mg daily has been used.

Because it's water-soluble, extra biotin will be excreted through the renal system. Most patients can tolerate the vitamin without difficulty, but some patients report mild side effects such as nausea and other digestive symptoms. There are no reported symptoms associated with biotin toxicity. However, clinical decision making based on inaccurate test results due to biotin lab interference have led to adverse events.

There are possible drug interaction with medications that are metabolized in the liver, specifically cytochrome P450 (CYP1B1) substrates. Examples of these medications include cyclobenzaprine, fluvoxamine, haloperidol, imipramine, olanzapine, propranolol, theophylline, zomitriptan, and others.[4]

Summary

While biotin is necessary for normal body function, and supplements may help pregnant women and certain patients with absorption issues, there is insufficient evidence to support supplementation or claims about healthy hair, skin, or nails. Because of potential interference with laboratory test results, high levels of biotin may lead to clinically significant missed diagnoses. Clinicians should routinely ask their patients if they are taking any non-prescribed supplements. Patients who want to take biotin should have specific diagnoses and understand that laboratory tests may be affected by biotin interference. Clinicians may want to recommend lower amounts of biotin supplements and holding supplements a few days before laboratory testing.

REFERENCES

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