Biotin for Hair Loss: Teasing Out the Evidence

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Background

- Biotin is vitamin B-7, also known as vitamin H from the German words "Haar und Haut", which mean "hair and skin". Biotin has long been glamorized as a hair supplement, but the scientific evidence supporting this claim has been surprisingly lacking.[1]
- Biotin is an essential cofactor for five mammalian carboxylase enzymes involved in gluconeogenesis, fatty acid synthesis, and amino acid catabolism.[2,3] Mammals cannot synthesize biotin, however deficiency is thought to be rare in industrialized countries since it is available in a wide range of foods (namely meat, fish, eggs, nuts, dairy, and some vegetables) and is produced by intestinal flora.[4,5] A balanced Western diet provides 35-70 mcg of biotin daily, which exceeds the daily adequate intake of 30 mcg.[4,6-8]
- It is well-known that patients who are biotin-deficient can display alopecia,[5] but it is flawed to presume that excess supplementation of this vitamin would be useful for hair growth.

Objective

Given biotin's widespread popularity as a hair supplement, we sought to review the literature regarding its efficacy for hair growth and quality.

Methods

We conducted a literature search of PubMed for articles specifically studying the use of oral biotin monotherapy for hair growth or quality. Case reports and case series were excluded. We used the following search terms: biotin AND (hair OR alopecia).

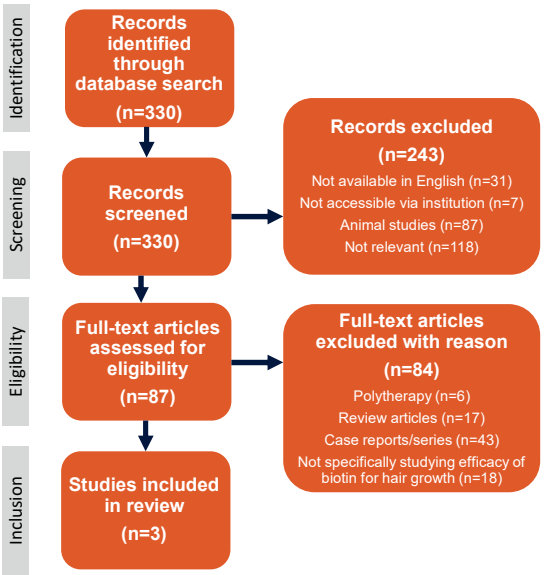

Figure 1. Summary of review conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines.

Results

Table 1. Summary of the three studies that met our inclusion criteria.

Study	Population	Dose	Study Design	Results
[9]*Pawlowski et al.,1966*	Females with diffuse pattern hair loss	10 mg daily x 4 weeks	Double-blinded, placebo controlled; Group 1: 28 patients took biotin; Group 2: 18 patients took placebo	Both groups improved from baseline. No significant difference in hair growth or sebum production between groups.
[10]*Aksac et al., 2021*	Patients taking isotretinoin	10 mg daily x 4 months	Group 1: 30 patients took isotretinoin and biotin; Group 2: 30 patients took isotretinoin only	Using trichoscopy, both groups had a decrease in terminal hair density. Group 1 had a significant shift toward anagen hairs compared to baseline.
[11]*Sen et al., 2021*	Females with hair loss after sleeve gastrectomy	1 mg daily	Group 1: 22 biotin-deficient patients took biotin x 3 months; Group 2: 29 biotin-sufficient patients took biotin x 2.5 months on average	23% of Group 1 reported remarkable decline in hair loss. 38% of Group 2 reported remarkable decline in hair loss. There was no significant difference between groups.

Table 2. Laboratory tests susceptible to biotin interference.[12,13]

Positive Interference (Falsely elevated)	Negative Interference (Falsely diminished)
Aldosterone	ACTH, FSH, HGH, LH, PTH, SHBG, TSH
Androstenedione	AFP
Anti-HAV Total	Anti-CCP
Anti-TSH receptor	Anti-HAV IgM
Anti-TPO	Anti-HBc IgM & HBsAg
Anti-Thyroglobulin (both)	Anti-HCV
Cortisol	Calcitonin & Procalcitonin
Cyclosporine	Cancer Ags (125, 15-3, 19-9, CEA, HE4, PSA)
DHEAS	Cardiac biomarkers (Troponin, CK-MB, Myoglobin)
Digoxin	EPO
Estradiol	Ferritin
Folate	Gastrin
FT3, FT4, T3, T4	HIV 1/2 Ag/Ab[15]
Progesterone	Insulin, IGF-1, C-peptide
Testosterone[14]	IgE
Vitamin B12	NT-proBNP
Vitamin D Total	Prolactin
17-OH-progesterone	Qualitative hCG[16]
25-Hydroxyvitamin D	

HAV, Hepatitis A virus; TSH, Thyroid stimulating hormone; TPO, Thyroid peroxidase; DHEAS, Dehydroepiandrosterone sulfate; FT3, Free triiodothyronine; FT4, Free thyroxine; ACTH, Adrenocorticotropic hormone; FSH, Follicle-stimulating hormone; HGH, Human growth hormone; LH, Luteinizing hormone; PTH, Parathyroid hormone; SHBG, Sex hormone binding globulin; AFP, Alpha fetoprotein; CCP, Cyclic citrullinated peptide; Ig, Immunoglobulin; HBc, Hepatitis B core; HBsAg, Hepatitis B surface antigen; HCV, Hepatitis C virus; Ags, Antigens; CEA, Carcinoembryonic antigen; HE4, Human Epididymis Protein 4; PSA, Prostate-specific antigen; CK-MB, Creatine kinase-myocardial band; EPO, Erythropoietin; HIV ½ Ag/Ab, Human immunodeficiency virus 1/2 antigen/antibody test; IGF-1, Insulin-like growth factor 1; NT-proBNP, N-terminal pro-brain natriuretic peptide; hCG, Human chorionic gonadotropin.

Discussion

- Table 1 displays the three studies that met our inclusion criteria.
  - The study by Pawlowski et al. is almost 60 years old and did not support the use of biotin for diffuse female alopecia.[9]
  - The study on biotin's utility in isotretinoin-associated alopecia as well as the study on sleeve gastrectomy patients focused on niche patient populations and, therefore, are not generalizable.[10,11] They also were not blinded, and therefore the results may have been affected by observer bias. Additionally, the results were not remarkably supportive of biotin.

Discussion Continued

- Despite minimal supporting evidence, biotin supplementation is pervasive in our society and recommended by many physicians for hair growth.[17,18]
- Biotin supplementation does not come without risk. Elevated serum biotin levels can interact with various laboratory immunoassays that could lead to a missed diagnosis, needless workups, undue distress, or fatal consequences. Table 2 lists laboratory tests susceptible to biotin interference. The Food and Drug Administration (FDA) has released two safety communications to spread awareness about potentially serious interactions.
- Standard microgram doses (30-60 mcg daily) often found in multivitamins are believed not to interfere with streptavidin-biotin assays.[19] Milligram doses (5-10 mg daily) can be found in over the counter supplements marketed for hair, skin, and nail growth, and can cause biotin interference, particularly in more sensitive assays like troponin.[19]
- Have patients stop biotin at least 2 days prior to laboratory testing (a week may be needed for high doses).[19,20]

Conclusion

Our review displays that the widespread marketing of biotin for hair loss in healthy individuals is unsubstantiated. The current literature comprised of low-quality studies does not support superfluous biotin administration in individuals with sufficient levels. Additionally, the lack of awareness about biotin's potential laboratory interference poses a potential hazard. To appropriately justify or dispel biotin's popularity as a hair supplement, randomized-controlled studies on biotin monotherapy for improving hair growth or quality in the target population (i.e., healthy individuals with self-perceived hair loss) are especially needed.

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