

A Review on Biotin (Vitamin H)

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Abstract: Vitamins have great importance for human health, growth, development maintenance and their deficiencies which results serious health issues and hazards. Thirteen vitamins considered as true vitamins which are also classified as water soluble and fat soluble vitamins. People normally aware and take about vitamin and mineral supplementation and diet as it means to control or to manage dermatological diseases and, inspecific, hairloss. The awareness of the population for an honest health and its interest in healthy nutrition has increased significantly during the last years. After the content of vitamins in his nourishment has gained value for the consumer, food has partially been vitaminized by the producer. When there exists a lack of biotin, seborrhea, dermatitis, anorexia, muscle pain, tiredness and nervous disorders can appear. As biotin is synthesized by the human intestine flora, deficiency symptoms are rare, seem show ever after excessive intake of raw egg white, which can be explained by its content of biotin binding avid in.

Keywords: Vitamins, Health hazards, Biotin, Biotin binding.

1. Introduction

Biotin is also known as vitamin B7, vitamin B8 or vitamin H. Biotin is a water soluble compound and it is colorless in appearance. Overall eight various types of biotin exist but only Biotin-D occurs naturally with its complete vitamin activity. It is mainly synthesized by mold, algae, bacteria, yeast and some of the plant species

Biotin, which is an necessary vitamin, helps in the health of skin, nerve and digestive system, and assists in releasing energy and metabolism of fats, protein and carbohydrates [1]-[4]. It also helps in the evaluation of embryonic development [5]-[7]. It has various function and effects on systemic processes and development [8], [9] assistance in immunity [10]. Biotin acts as prosthetic group of carboxylases; it is a hydro-soluble vitamin. Biotin also regulates gene expression unrelated to its role as carboxylase prosthetic group [11], [12]. Deficiency in the biotin may lead to the neurological disease and affect the skin and hair growths [13].

2. What is biotin?

Previously this was called as coenzyme R, vitamin H, and vitamin B7 but now called as biotin, member of B-complex. Most importantly biotin plays an important role in sugar and fat metabolism. Biotin is also known vitamin B7, vitamin B8 or vitamin H. Biotin is a water soluble compound and is colorless in look. Overall eight various types of biotin exist but only

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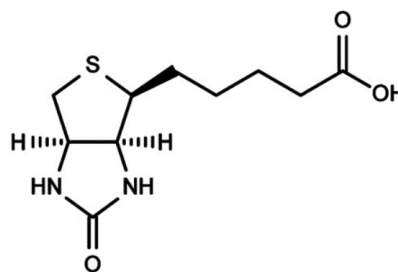


Fig. 1. Structure of Biotin

3. Biological importance

Insulin, hormone that maintains sugar balance in body, production and functioning on cell are impaired due to lack of biotin. Skin rashes are also caused by biotin deficiency as this is required for fat deposition in the skin. These fats are required for maintaining the skin moist and supple whereas, if it remains deficit fats, skin becomes irritated and flaky or scaly. Symptoms of cradle cap can be reduced in nursing infants by increasing intake of biotin in food of lactating mothers. Skin rash, cradle cap, seborrheic dermatitis, hair loss, diabetes, brittle nails, pregnancy issues and seizures are the problems associated with deficiency of this vitamin.

A. Biological requirement of biotin

Table 1
Established AI levels of biotin per the food and nutrition board of the institute of medicine

Life stage	Age	Males, µg/day	Females, µg/day
Infants	0 – 6 months	5	5
Infants	7 – 12 months	6	6
Children	1 – 3 years	8	8
Children	4 – 8 years	12	12
Children	9 – 13 years	20	20
Adolescents	14 – 18 years	25	25
Adults	≥19 years	30	30
Pregnancy	all ages	n/a	30
Breast-feeding	all ages	n/a	35

B. Deficiency of biotin

Biotin deficiency can be genetic or acquired. Genetic causes of biotin deficiency can be either neonatal or immature. The neonatal type is a life-threatening phase manifested during the first 6 weeks of life, and it is due to a holocarboxylase enzyme deficiency. It is usually manifested with serious dermatitis and alopecia, where there is reduction of vellus and terminal hair on the scalp; eyebrows, eyelashes, and lanugo hair can also be absent. The infantile form of biotin deficiency occurs after 3 months of delivery and is due to a lack of the enzyme called biotinidase. In this form, hair of the scalp, eyebrows, and eyelashes is sparse or totally absent [15]. Acquired biotin insufficiency can be due to increased raw egg consumption, where avidin particles attach to biotin and inhibit its absorption into the intestinal gut. In cooked eggs the avidin particles are destroyed [16]. Other causes of acquired biotin deficiency include states of malabsorption, alcoholism, pregnancy, prolonged use of antibiotics that interrupt normal flora, medications such as valproic acid, and isotretinoin intake. The aforementioned medications interfere with biotinidase activity [15]. Evidence suggests that 50% of pregnant women are deficient in biotin [17].

C. Sources of biotin

A wide range of foods contain biotin. None of them have large amount, as is the case with some other vitamin. Foods that have slightly higher amount of biotin include:

1. Liver
2. Peanuts
3. Yeast
4. Whole wheat bread
5. Cheddar cheese
6. Pork
7. Salmon
8. Sardines
9. Avocado
10. Raspberries
11. Bananas
12. Mushrooms
13. Cauliflower
14. Egg yolk

D. Signs and symptoms of biotin deficiency

Signs of biotin insufficiency include hair loss, skin rashes, and brittle nails, the efficacy of biotin additives for hair, skin, and nails as a means to remedy these conditions is not supported in large-scale studies [18, 19]. In fact, only case reports have been used to justify the use of biotin additives for hair growth. These case reports were in children and found that 3–5 mg biotin daily could improve hair health after 3–4 months in children with uncombable hair syndrome [20], [21].

E. Use of biotin for nails and hair loss

A recent review article evaluating biotin and its result on human hair found 18 reported cases of biotin use on hair and

nail. In ten of these 18 cases there was a genetic reason of biotin deficiency; the remaining eight patients had alopecia that was improved after they had taken biotin supplementation. There were 3 cases of non combable hair syndrome, 3 cases of breakable nail syndrome, 1 case of alopecia due to valproic acid intake, and 1 case of an infant on a biotin-free dietary supplement. All of these 18 patients had underlying causes of biotin deficiency and, once treated with biotin supplement, showed clinical improvement in a variable time period [16].

4. Conclusion

Different methods and processes for determination of vitamins and nutrients are used. Biotin is a specific vitamin helping in the anabolism and catabolism of carbohydrates and protein. Though its use as a hair and nail growth additives is frequent, research demonstrating the potency of biotin is limited. In cases of acquired and genetic causes of biotin insufficiency as well as pathologies, such as breakable nail syndrome or non combable hair, biotin additives may be of benefit. However, we propose these cases are uncommon and that there is insufficient evidence for supplementation in healthy individuals. Given the role of vitamins and minerals in regular hair follicle development and in immune cell activity, large double-blind placebo-controlled trials are required to determine the effect of micronutrient additives on hair growth in those patients with both micronutrient insufficiency and non-scarring alopecia to establish any association between hair loss and micronutrient deficiency. Each study conducted to date has its own specific limitation, and the constraint of cost and lack of motivated funders for this research are significant limitations.

References

- [1] Wang, J., Liu, X.D. and Schnute, W. (2000) Simultaneous Analysis of Water-Soluble Vitamins in Vitamin-Enriched Beverages and Multivitamin Dietary Supplements. UHPLC-MS/MS, Sunnyvale, CA.
- [2] De Leenheer, A.P. and Lambert, W., Eds. (2000) Modern Chromatographic Analysis of Vitamins: Revised and Expanded. Vol.84. CRC Press, Boca Raton.
- [3] Marquet, A., Bui, B.T. and Florentin, D.; Biosynthesis of Biotin and Lipoic Acid. *Vitamins & Hormones*, 2001;6(1);51-101.
- [4] Bellows, L. and Moore, R. (2012) Water-Soluble Vitamins: B-Complex and Vitamin C. Fact Sheet No. 9.312.
- [5] Swartz, M.E. (2005) UPLC™: An Introduction and Review. *Journal of Liquid Chromatography & Related Technologies*, 2012;28,1253-1263.
- [6] Watanabe, T., et al. Effects of Biotin Deficiency on Embryonic Development in Mice. *Nutrition*, 2009;5, 78-84.
- [7] Watanabe, T. and Endo, A. (1990) Teratogenic Effects of Maternal Biotin Deficiency on Mouse Embryos Examined at Midgestation. *Teratology*, 42, 295-300.
- [8] Watanabe T, Morphological and Biochemical Effects of Excessive Amounts of Biotin on Embryonic Development in Mice. *Experientia*, 1996; 52, 149-154.
- [9] Báez-Saldaña, A., Díaz, G., Espinoza, B. and Ortega, E. (1998) Biotin Deficiency Induces Changes in Subpopulations of Spleen Lymphocytes in Mice. *American Journal of Clinical Nutrition*, 64, 431-437.
- [10] Báez-Saldaña, A. and Ortega, E. (2004) Biotin Deficiency Accelerates Thymus Involution, Blocks Thymocyte Maturation and Decreases Nose-Rump Length in Mice. *Journal of Nutrition*, 2004; 13(4), 1979-1987.
- [11] Rodriguez-Melendez, R. and Zemleni, J. (2003) Regulation of Gene Expression by Biotin. *The Journal of Nutritional Biochemistry*, 14, 680-690.

- [12] Dakshinamurti, K. and Chauhan, J. (1994) Biotin-Binding Proteins. In: Dakshinamurti, K., Ed., Vitamin Receptors: Vitamins as Ligands in Cell Communication, Vol. 1, Cambridge University Press, Cambridge, 200-249.
- [13] Thapar, R. and Venkatnarayan, K. (2013) A Case of Biotinidase Deficiency Presenting as Quadriparesis. *Indian Journal of Clinical Practice*, 24, 680-683.
- [14] Institute of Medicine (US) Standing Committee on the Scientific Evaluation of Dietary Reference Intakes and Its Panel on Folate, Other B Vitamins, and Choline. Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline. Washington, National Academies Press (US), 1998.
- [15] Goldberg LJ, Lenzy Y. Nutrition and hair. *Clin Dermatol*. 2010;28(4):412-9.
- [16] *Dermatol Ther (Heidelb)*;2019;9(1):51-70
- [17] Durusoy C, Ozenli Y, Adiguzel A, et al. The role of psychological factors and serum zinc, folate and vitamin B12 levels in the aetiology of trichodynia: a case-control study. *Clin Exp Dermatol*. 2009;34(7):789-92.
- [18] Zempleni J, Hassan YI, Wijeratne SS. Biotin and biotinidase deficiency. *Expert Rev Endocrinol Metab*. 2008;3(6):715-24.
- [19] Zempleni JWS, Kuroishi T. Biotin. Present knowledge in nutrition. 10th edn. Washington, DC: Wiley-Blackwell; 2012. p. 359-74.
- [20] Mock DM. Biotin. In: Coates PM, Blackman M, Betz JM, Cragg GM, Levine MA, Moss J, White JD, editors. *Encyclopedia of dietary supplements*, edn. 2, London, New York: Informa Healthcare; 2010. pp. 43-51.
- [21] Boccaletti V, Zendri E, Giordano G, Gnetti L, De Panfilis G. Familial uncombable hair syndrome: ultrastructural hair study and response to biotin. *Pediatr Dermatol*. 2007;24(3):E14-6.
- [22] Shelley WB, Shelley ED. Uncombable hair syndrome: observations on response to biotin and occurrence in siblings with ectodermal dysplasia. *J Am Acad Dermatol*. 1985;13(1):97-102.