Biotin (also known as Vitamin H) is part of the water soluble B-vitamins and plays an important role in metabolism and hoof formation. Biotin has the following chemical structure:

![Biotin Chemical Structure](image)

It is widely found in most common feedstuffs with highest levels in plant proteins (extracted oilseed meals) and yeast but the levels are variable and the biotin is not readily available for the animals. It is also synthesised by bacteria in the intestines. The biotin in most grains is relatively unavailable to the animal except in maize which is completely available. It was thought previously that ruminants are able to utilise and synthesise sufficient amounts of biotin but recent research indicates that supplementation might be beneficial especially for dairy cows during the transition period (ruminal biotin synthesis decreases with higher energy diets). Biotin synthesis also occurs in the lower end of the gastrointestinal tract in horses but due to limited absorption from the large intestine, this synthesised biotin is not available to the animal and excreted.

Biotin is an essential co enzyme for various enzymatic pathways involved in the metabolism of carbohydrate, protein and fat especially carboxylases (catalysing transfer of Carbon Dioxide into other substrates):

- It is involved in gluconeogenesis and fatty acid synthesis by activating the enzyme Pyruvate carboxylase which converts stored energy into usable glucose.
- Function in formation of RNA and production of Keratin.
- Acetyl-CoA carboxylase converts acetyl-coenzyme A to malonyl-coenzyme A involved in fatty acid elongation (lipogenesis).
- Part of Propionyl-CoA carboxylase which catabolizes amino acids and some fatty acids.

Biotin’s more common function is for the role it plays in hoof, horn and hair quality. Hooves are essentially like human nails made up of a structural protein called Keratin. Biotin is needed in keratin formation and a deficiency would lead to poor, brittle hooves and other ailments. Supplementation is necessary during the growing phase as hoof formation takes time and improvement in hoof health will not be seen immediately as it takes about 9 months for new hoof horn to form. It has also been found that biotin supplementation increases milk production in dairy cows but the reasoning for this is not quite clear yet (possibly increased
glucose production or fibre digestion).

If deficiency occurs when a diet with sufficient biotin levels is fed, it can be due to presence of antagonist (bind the available biotin and renders it unavailable for absorption). This include avidin (protein found in egg albumen), Streptavidin (bacteria of Streptomyces species in feed and bedding) and peroxidising fats.

Signs of deficiency are:

- Hoof defects like lesions, sole ulcers, digital dermatitis, swelling of the feet and cracks eventually lead to lameness.
- Poor reproductive performance (reduced litter size and weight, slow return to oestrus and reduced conception at first service).
- Growth rate is reduced.
- Deficient pigs are spastic, stand with their legs forward, sits like a dog, dermatitis and hair loss, dry, scaly skin, transverse grooves and white film on tongue.
- Leg weakness due to thickening and shortening of the long bones, twisting of the hock joints (inward or outward) and slipped tendons (perosis) in poultry are common as well as unthriftiness, poor feathering and dermatitis on the beak and footpad. Can also lead to small, imperfect extremities (micromelia) and digits fused together (syndactylism) in combination with manganese deficiency and genetic disorders.
- Perosis in chicks
- Embryo mortality at days 3 to 7 and later than day 17 are due to haemorrhage of the embryo and will reduce hatchability of eggs.
- Biotin deficiency can lead to fatty liver and kidney syndrome due to the inability to metabolise fats and accumulation thereof in the liver (giving it the yellow colour). Normally results in death (with head backwards and upwards) as gluconeogenesis is impaired and blood glucose levels aren't maintained.
- Skin conditions in dogs and cats are the most common sign of deficiency and include dull, faded, dry hair which falls out, dermatitis, scabs, scar easily and itchy skin.

Toxicity aren’t common due to very limited storage and efficient excretion of biotin through the kidneys but embryo reabsorption might be due to excessive levels.

Recommended supplementation for existing or possible hoof or skin problems (can be adjusted based on situation):

<table>
<thead>
<tr>
<th>Species</th>
<th>Supplementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy cows (during transition period)</td>
<td>10-20mg/day</td>
</tr>
<tr>
<td>Adult horses (supplemented at least 6-9 months)</td>
<td>15mg/day</td>
</tr>
<tr>
<td>Pigs (supplemented at least 6-9months)</td>
<td>5mg/sow/day</td>
</tr>
<tr>
<td>Pets with skin conditions (supplemented for 3-5 weeks)</td>
<td>5mg/10kg body weight</td>
</tr>
</tbody>
</table>

Even though biotin is present in feed and can be synthesised in the animal’s digestive tract, it can still be beneficial to supplement it on a daily basis especially in today’s stressful production systems.

References - Books