

Relationship of zinc, biotin and iron with cases of hair loss in cats

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Abstract

The current study aimed to find out the relationship of zinc, iron, biotin, with cases of hair loss in cats. The collection of samples began from April to September 2022, samples were collected from 100 domestic cats (80 cats suffering from shedding and 20 healthy cats) with ages ranging from 6 months to 2 years. Blood samples were collected for serological tests (zinc, iron and biotin). The observed clinical signs included easy hair loss, causing hair loss in a limited or wide area, and the results also found that the skin condition is normal and there is no redness or any skin lesions, which confirms that the cause of hair loss is not infectious. Vital rates such as pulse, temperature and respiration were not affected in both groups. The animals suffering from hair loss showed a clear significant decrease in the level of biotin and iron, zinc as compared to healthy animals. Biotin and zinc significantly over the rest of the other causes of hair loss, as the current study proved that zinc and biotin are among the most important causes of hair loss in cats.

The current study concluded that hair loss in cats is one of the important cases that are frequently reported to veterinary clinics. The study also concluded that there are several reasons for hair loss in cats, the most important of which is zinc and biotin deficiency.

Keywords: *Biotin, zinc, iron, hair, cats.*

INTRODUCTION

Breakage or lack of hair density and hair loss are common symptoms in domestic animals (Moriello, 2012; Kennis, 2008). Hair loss indicates the primary condition, and hair loss indicates the latter (Breathnach and Shipstone 2006). The differential diagnosis for both conditions is very broad. What facilitates the process of diagnosis is the history taking and identification of the pattern and form of precipitation by experienced doctors.

Zinc enters enterocytes primarily in the form of ligand-bound Zn such as peptides, amino

acids, nucleotides and possibly free zinc, with zinc solubility being an important determinant of absorption. Agents proposed as affecting zinc bioavailability fall into two categories, (i) chelating agents (eg, phytic acid), and (ii) interactions of metal ions (eg, copper, cadmium, and iron) (Baker and Ammerman, 1995). It is clear that the importance of some other dietary compounds, especially calcium, depends on the animal species and the type of diet (Sandstrom and Lonnerdahl, 1989).

It was found that the lack of zinc density in pets that were given general foods occurs

significantly (Sousa et al. 1988 and Huber et al. 1991), in general, these foods were high in plant products (phytates) and did not contain zinc sufficiently, it was shown Pets that consume these diets develop parakeratotic skin lesions with hair loss in these areas.

Very little information is available about zinc deficiency and excessive hair loss in research. It was found that changing cats from an adequate diet to a diet low in zinc density resulted in a rapid decrease in food intake, increased body weight, and hair loss, with a decrease in plasma zinc concentration (Kane et al. 1981).

Vitamin B complex contains a number of essential nutrients: thiamine (B1), riboflavin (B2), niacin (B3), pantothenic acid (B5), pyridoxine (B6), biotin (B7), folic acid (B9), and cobalamin (B12). In general, B vitamins are enzyme cofactors and precursors that are required for many metabolic processes throughout the body. Of the B vitamins, only cobalamin cannot be found in any plant material. Cobalamin is made only by microbes in soil, fermenting organic matter and in specific parts of the digestive tract of animals (Maugh, 1973).

Although biotin densities are known to cause hair loss (Zempleni et al., 2008), the exact mechanism responsible for the symptoms of hair loss is still unclear. However, biotin has been shown to play a role in keratinocyte proliferation and differentiation in HaCaT cells (Grafe et al, 2003). Biotin hypodensity hair loss is considered to be a failure of hair retention caused by false keratinization of the hair shaft (Rauch, 1952), indicating that the hair shaft separates easily, away from the follicle.

Unlike zinc, iron is abundant on Earth (Quintero-Gutiérrez et al., 2008) and is a biologically essential component of every living organism (Aisen et al., 2001).

When reviewing articles that documented the relationship between iron and hair loss, including female pattern hair loss (FPHL), alopecia areata, alopecia universalis or totalis, some (Guggenheim, 1995, Yip et al., 1996) advocated that there is a close association between iron and hair loss, while others were against this theory (Guerinot, 1994, Lieu et al., 2001).

This study designed to investigate the relationship of zinc, biotin and iron with cases of hair loss in cats.

Materials and Methods:

The collection of samples began from April until September of 2022, when samples were collected from 100 (80 cats suffering from hair loss and 20 healthy cats and cats) at home, with ages ranging from 6 months to 2 years, as the animals were suffering from easy hair pulling. Some of them suffered from obvious hair loss and voids in the hair.

Blood samples were collected from cats for serological investigations (zinc, iron and biotin), which purchased from Linear and blood samples were collected from the cephalic vein (Merrill, 2012).

Statistical analysis was done by using SPSS version 23.

Results and discussions:

The noticeable clinical signs included easy hair loss (Figure 1), which caused hair loss in a limited or wide area (Figure 2), and the results also found that the skin condition is normal and there is no redness or any skin lesions, which confirms that the cause of the loss is not Contagious.

Figure 1. The hair falls out easily in the hand



Figure 2. Partial hair loss in cats



Vital test results:

Table (1) showed that vital rates such as pulse, temperature and respiration were not affected in both groups.

Table 1 shows the vital rates of healthy and precipitated animals

Clinical examination	Control animals	Animals with alopecia
Temp. $^{\circ}\text{C}$	$38.3 \pm 0.03 \text{ A}$	$38.4 \pm 0.01 \text{ A}$
Pulse rate	$112 \pm 0.36 \text{ A}$	$114.2 \pm 1.46 \text{ A}$
Respiratory rate	$24.1 \pm 0.2 \text{ A}$	$23.9 \pm 0.03 \text{ A}$

Maghraby and Mahmoud, 2021 found that zinc-induced hair loss did not cause a change in body temperature, respiratory rate, and heart rate in affected calves. Sarwar et al. (2021) that vital tests such as temperature, pulse, and respiration do not change with a deficiency of water-soluble vitamins, especially B vitamins, and this is consistent with the results of the current study.

Biotin and mineral test results:

1. Biotin:

Animals suffering from hair loss showed a significant decrease in biotin level (7.38 ± 0.02) compared to healthy animals (12.73 ± 0.81) (Table 2).

Table 2 Biotin levels in healthy and animals with hair loss

Test name	Animals with hair loss	Control
Biotin	$7.38 \pm 0.02 \text{ B}$	$12.73 \pm 0.81 \text{ A}$

Biotin deficiency can cause hair loss in cats, in addition to other symptoms such as dry skin, scaly skin, and brittle claws (Pastoor et al., 1991). Biotin is a B vitamin that is essential

for healthy skin and hair in cats. Deficiency can occur if cats do not get enough biotin in their diet or if they have an underlying medical condition that interferes with biotin absorption or metabolism (Villaverde & Chandler, 2022). Agreed The current study, with the results of both (Carey and Morris, 1975, 1977), who proved that biotin deficiency plays an essential role in hair loss.

.2 Iron and zinc:

The results of the current study found that the levels of iron and zinc were affected as they showed a significant decrease in animals suffering from precipitation (71.27 ± 0.08), (79.6 ± 0.6) compared to healthy animals (85.7 ± 0.94), (92.13 ± 0.2), respectively (Table 3).

Table 3 Iron and zinc levels in healthy and animals with hair loss

Tests	Animals with hair loss	Control
Iron µg/dL	71.27± 0.08B	85.7 ±0.94 A
Zinc µg/dL	79.6± 0.6 B	92.13±0.2 A

Researchers have reported that zinc deficiency can cause hair loss in cats, in addition to other clinical signs such as skin lesions, poor hair condition, and diarrhea (Kane et al., 1981). Zinc is an essential mineral that plays a vital role in many bodily functions in humans and animals, including skin and hair health (Cunha et al., 2022). Zinc deficiency can lead to a condition called zinc-responsive dermatitis, which is characterized by hair loss, dry, flaky skin, and other skin problems, specific to domestic animals (Attia et al., 2022).

Iron is essential to almost all living organisms and is integral to multiple metabolic functions,

the most important function being the transport of oxygen in hemoglobin (Naigamwalla et al., 2012). The results of our current study have proven that iron deficiency has a role in hair loss, and this has been proven by several studies in humans (Park et al., 2013, Treister-Goltzman et al., 2022) and cats (Case et al., 2010, Hunt & Jugan, 2021).

Conclusion:

1. Hair loss in cats is one of the important cases frequently reported to veterinary clinics.
2. There are several reasons for hair loss, the most important of which is zinc and biotin deficiency.

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