

TECHNICAL MONOGRAPH

PRODUCT NAME: Hoofmaster

CONSTITUENTS:	Common Name	Botanical Name
	B Vitamins (B1, B2, B5, B6, B12 - cyanocobalamin)	
	beet pulp	<i>Beta vulgaris</i>
	biotin	
	cholecalciferol (vitamin D3)	
	choline	
	cobalt	
	copper sulfate	
	ferrous sulfate (iron)	
	folic acid	
	flaxseed	<i>Linus usitatissimum</i>
	iodine	
	lysine	
	manganese sulphate	
	manganese proteinate	
	DL-methionine	
	tocopherols, mixed	
	vitamin A acetate	
	zinc	

INTENDED PURPOSE

Hoofmaster is a vitamin and mineral supplement, with flaxseed and beet pulp, designed to provide the nutrients important for hoof growth, repair and maintenance. Hoofmaster also provides nutritional support to many other systems and structures in the body. Hoofmaster is a low glycemic formula, making it safe for Cushings horses.

EVIDENCE FOR EFFICACY

- **LINUS USITATISSIMUM (FLAXSEED)** IS RICH IN OMEGA-3, OMEGA-6 OILS, ALPHA-LINOLEIC ACID, DIETARY FIBERS, SECOISOLARICRESINOL DIGLUCOSIDE, PROTEIN AND MINERALS. ITS HEALTH BENEFITS INCLUDE BEING AN ANTIOXIDANT AGENT, PREVENTIVES AGAINST CARDIOVASCULAR DISEASES, CANCER, DIABETES AND ENHANCEMENT OF SPATIAL MEMORY. **FLAXSEED** ALSO HAS DEMONSTRATED ANTI-INFLAMMATORY ACTIVITY WHEN FED TO HORSES FOR 70 DAYS (VINEYARD ET AL. 2010; AKHTAR ET AL. 2013).
- **Beta vulgaris** (beet, beetroot, sugar beet, swiss chard, red beet) possess a high content of beneficial prebiotic starches that promote the growth and proliferation of beneficial (probiotic) gut bacteria such as Lactobacillus spp. and Bifidobacterium spp. The starch also stimulates bacteria that elicit anti-inflammatory responses and produce acetate and other beneficial volatile fatty acids, or VFAs (Vigsnaes et al. 2011; Sulet et al. 2014) and improves blood lipid profile (Hallebeek and Beynen 2003). Dietary **beet pulp** also improves the blood lipid profile and has anti-oxidant activity (Jiratanan and

- and other beneficial volatile fatty acids, or VFAs (Vigsnæs et al. 2011; Suller et al. 2014) and improves blood lipid profile (Hallebeek and Beynen 2003). Dietary **beet pulp** also improves the blood lipid profile and has anti-oxidant activity (Jiratanan and Liu 2004).
- **B Vitamins. Thiamine** (Vitamin B1) has important roles in neural regulation, cognitive performance and mental health. It is also important in the development and maintenance of healthy cell membranes and connective tissue. (Benton et al. 1997; Zhang et al. 2013). **Riboflavin** (Vitamin B2) is a water-soluble vitamin present in meat, fish and certain fruit and vegetables, especially dark-green vegetables. Riboflavin deficiency can occur in a matter of days, resulting initially in impaired psychomotor function, then skin lesions that may be due to impaired skin collagen maturation. Riboflavin appears to interact synergistically with other vitamins, notably folate and vitamin B-6, thus compounding the effects of a deficiency of any of these. (Lakshmi 1998; Powers 2003; McNulty and Scott 2009). **Niacin** (Vitamin B3, niacinamide) is one of the B complex vitamins and has important roles in beneficially altering the blood lipid profile and enhancing lipid composition of structural tissues (MacKay et al. 2012). **D-Pantothenic acid** (Vitamin B5) is essential in the diet and is one of the coenzymes involved in fatty acid synthesis within cells of the body. A deficiency of vitamin B5 can be associated with impaired growth and health. (Rébeillé et al. 2007). **Pyridoxal phosphate** (the active form of **Vitamin B6**): the main metabolic function of vitamin B6 is in muscle amino acid and glycogen metabolism, as well as in the actions of steroid hormones. The major dietary requirement is to meet physiological stresses such as growth, pregnancy, lactation, vigorous exercise, and/or disease. Deficiencies of the vitamins folate, B12, and B6 are associated with neurological and psychological dysfunction and with birth defects. (Selhub et al. 2010; Morris 2012). Cyanocobalamin is the most common and widely produced compound that has **vitamin B12** activity. **Vitamin B12** metabolism and function is closely associated with that of folate and B6. Folate and vitamin B12 deficiencies result in anemia, neurologic conditions, neurodevelopmental disorders and birth defects. For horses in heavy training the tissue requirement for vitamin B12 may rise as a consequence of the increase in the rate of energy metabolism (Doets et al. 2013; Roberts 1983; Frape 1988; Randaccio et al. 2010).
 - **BIOTIN** IS A WATER-SOLUBLE VITAMIN AND AN ESSENTIAL COENZYME FOR FIVE CARBOXYLASES. BIOTIN-DEPENDENT CARBOXYLASES PLAY CRUCIAL ROLES IN THE METABOLISM OF FATTY ACIDS, AMINO ACIDS AND GLUCOSE. BIOTIN DEFICIENCY IS ASSOCIATED WITH NUMEROUS METABOLIC AND GENOME DISEASES. BIOTIN SUPPLEMENTATION IS BENEFICIAL FOR HEALTHY KERATIN GROWTH – THE HORSES HOOVES ARE COMPOSED MAINLY OF KERATIN (CASHMAN AND SLOAN 2010; ZEMPLINI ET AL. 2008).
 - **VITAMIN D3** (CHOLECALCIFEROL). IN GENERAL, VITAMIN D IS A GROUP OF FAT-SOLUBLE SECOSTEROIDS THAT ENHANCE INTESTINAL ABSORPTION OF CALCIUM AND PHOSPHATE, AND ARE INVOLVED IN SKIN, HAIR AND NAIL GROWTH AND HEALTH. VITAMIN D3 CAN BE SYNTHESIZED BY THE SKIN WHEN EXPOSURE TO SUNLIGHT IS ADEQUATE. VITAMIN D STATUS OF HORSES MAY BE COMPROMISED DURING THE WINTER MONTHS. A METABOLITE OF VITAMIN D3 HAS INFLAMMATORY POTENTIAL AND INDUCES KERATINOCYTE DIFFERENTIATION, IMPORTANT IN HAIR AND HOOF GROWTH. THE METABOLITE MAY ALSO REGULATE THE AMOUNT OF ANTIMICROBIAL PEPTIDES PRODUCED BY THE SKIN (MORIZANE ET AL. 2010; MÄENPÄÄ ET AL. 1988; BREIDENBACH ET AL. 1998).
 - **CHOLINE** IS AN ESSENTIAL NUTRIENT WITH A WIDE RANGE OF BIOLOGICAL FUNCTIONS INCLUDING NERVE FUNCTION AND OSMOREGULATION. CHOLINE IS ALSO AN IMPORTANT COMPONENT OF STRUCTURAL LIPOPROTEINS INCLUDING THOSE FOUND WITHIN SKIN AND HOOVES, BLOOD AND MEMBRANE LIPIDS (SCHEINFELD ET AL. 2007; UELAND 2011; CORBIN AND ZEISEL 2012).
 - **COBALT** (COBALT SULPHATE) IS AN ESSENTIAL TRACE MINERAL AND AN ESSENTIAL COMPONENT OF VITAMIN B12. TOGETHER, THEY ARE IMPORTANT FOR GROWTH AND HEALTH (STILLIONS ET AL. 1971; FRAPE 1988; RANDACCIO ET AL. 2010).
 - **COPPER** (COPPER SULFATE; COPPER AMINO ACID CHELATE) IS ESSENTIAL TRACE MINERAL THAT IS NEEDED FOR PROPER FUNCTIONING OF ENZYMES INVOLVED COMBATTING OXIDATIVE STRESS, AND OF ENZYMES INVOLVED IN THE SYNTHESIS AND MAINTENANCE CARTILAGE AND OTHER ELASTIC TISSUES, IRON STORAGE, MITOCHONDRIAL INTEGRITY (WAGNER ET AL. 2011; GEE ET AL. 2007; MICROMINERAL REQUIREMENTS IN HORSES [HTTP://WWW.KER.COM/LIBRARY/ADVANCES/239.PDF](http://www.ker.com/library/advances/239.pdf)).
 - **IRON** (FERROUS SULPHATE) IS A TRACE MINERAL THAT IS ASSOCIATED WITH MUSCLE AND RED BLOOD CELL OXYGEN TRANSPORT FUNCTIONS. IRON DEFICIENCIES IN HORSES MAY OCCUR WHEN FORAGES CONTAIN VERY LOW OR NO AMOUNTS OF IRON AND COPPER. IRON IS ALSO ONE OF THE

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- **FOLATE (FOLIC ACID)** IS AN IMPORTANT VITAMIN IN MAINTAINING GROWTH, DEVELOPMENT AND HEALTH. IT IS CLOSELY ASSOCIATED IN ITS FUNCTION WITH VITAMIN B12. DEFICIENCIES OF THE VITAMINS FOLATE, B12, AND B6 ARE ASSOCIATED WITH NEUROLOGICAL AND PSYCHOLOGICAL DYSFUNCTION AND WITH CONGENITAL DEFECTS. PERMANENTLY STABLED HORSES AND SOME HORSES IN TRAINING MAY REQUIRE ADDITIONAL FOLIC ACID, PREFERABLY ON A DAILY BASIS BY THE ORAL ROUTE (SELHUB AND PAUL 2011; HUGHES ET AL. 2013; ROBERTS 1983; SELHUB ET AL. 2010).
- **IODINE (POTASSIUM IODIDE)** IS AN ESSENTIAL TRACE ELEMENT AND AN IMPORTANT COMPONENT IN THE THYROID HORMONES THYROXINE AND TRIIODOTHYRONINE THAT ARE IMPORTANT IN REGULATING GROWTH, DEVELOPMENT AND REPRODUCTION IN HORSES AND OTHER ANIMALS. IODINE DEFICIENCY IS ASSOCIATED WITH GOITER AND CRETINISM. IODINE DEFICIENCY IS THE PRIMARY CAUSE OF GOITER IN FOALS, HOWEVER EXCESSIVE LEVELS OF IODINE MAY ALSO GOITER (WEHR ET AL. 2002; MICROMINERAL REQUIREMENTS IN HORSES [HTTP://WWW.KER.COM/LIBRARY/ADVANCES/239.PDF](http://www.ker.com/library/advances/239.pdf)).
- **LYSINE (L-LYSINE)** IS A DIETARY INDISPENSABLE AMINO ACID AND IS USUALLY THE MOST LIMITING DIETARY AMINO ACID FOR BODY PROTEIN SYNTHESIS. LYSINE IS THE FIRST LIMITING AMINO ACID IN MOST GRAIN- AND CEREAL-BASED ANIMAL DIETS, AND THEREFORE DEFINES THE PROTEIN INTAKE REQUIRED TO MEET THE ANIMALS' AMINO ACID REQUIREMENTS. HORSES FED A LYSINE-CONTAINING AMINO ACID SUPPLEMENT SHOWED IMPROVED MAINTENANCE OF MUSCLE MASS ACROSS ALL AGES. FOALS AND YEARLING SUPPLEMENTED WITH LYSINE GREW AT THE SAME OR GREATER RATES THAN THOSE RECEIVING A CONTROL SUPPLEMENT, INDICATING BOTH A REQUIREMENT AND A BENEFIT FOR THE FIRST TWO YEARS OF GROWTH (GRAHAM ET AL. 1994; STANIAR ET AL. 2001; BALL ET AL. 2007).
- **MANGANESE (MANGANESE SULFATE; MANGANESE PROTEINATE)** IS A TRACE MINERAL THAT IS ESSENTIAL FOR CARBOHYDRATE AND LIPID METABOLISM, FOR SYNTHESIS OF THE CHONDROITIN SULFATE NECESSARY FOR CARTILAGE FORMATION, AND FOR BONE HEALTH. MANGANESE ALSO HAS ANTI-OXIDANT ACTIVITY IN HORSES. SEDENTARY HORSES REQUIRE 409 MG/DAY. TRACE MINERAL SUPPLEMENTATION MAY HAVE A POSITIVE EFFECT ON BONE MINERAL DEPOSITION IN YEARLING HORSES (SINGH ET AL. 1992 ; OTT AND ASQUITH 1989; ZOFKOVA ET AL. 2009).
- **Methionine** is one of two sulfur-containing amino acids, and is important in the synthesis of cysteine, carnitine, taurine, lecithin, and key cell membrane phospholipids. It is helpful to the digestive system and is important in the removal of heavy metals from the body. Methionine also has antioxidant activity, and is used to treat depression, arthritis pain and chronic liver disease. It is also one of the three amino acids needed by the body to manufacture creatine monohydrate, a compound essential for energy production and muscle building (Zicker and Rogers 1994; Burd et al. 2011).
- **Tocopherols are a class of organic chemical compounds related to vitamin E, and of which many have vitamin E activity. They are associated with anti-oxidant effects when used a nutritional supplements (Williams and Burke 2012).**
- **Vitamin A affects growth and reproduction in horses, and horses may become depleted of the vitamin in late fall and winter when they are off pasture (Greiwe-Crandell et al. 1995, 1997; Blakley and Bell 1994; Donoghue et al. 1981).**
- **Zinc (zinc amino acid chelate; zinc sulphate) is a trace mineral and a component of many metalloenzymes. Sedentary, adult horses require 260 mg of zinc per day, which may not always be readily available from the diet, and zinc is not stored in the body. Zinc, and its complexed enzymes and other molecules, are involved in enhancing immune responses, in reducing oxidative stress, in apoptosis and in ageing. Zinc supplementation has effects consistent with slowing of ageing (Wagner et al. 2011; Stefanidou et al. 2006; Chien et al. 2006; Frassinetti et al. 2006).**

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- processing are indirectly controlled in keratinocytes by calcium, vitamin D(3), and retinoic acid. *J Invest Dermatol.* 2010 May;130(5):1297-306.
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