



Nutritional Deficiency of Farm Animals: A Review

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Introduction

The introduction of the article "Nutritional Diseases of Farm Animals" delves into the repercussions of modern agricultural practices on animal nutrition. It underscores the critical need to comprehend and prevent nutritional diseases in livestock. The text emphasizes the difficulties associated with intensive production practices, in which livestock are frequently lot- or stall-fed year-round on commercial feeds with little access to pasture. Nutritional deficiencies can result from poor feed selections or low-quality feed, which can set off significant nutritional disorders. The section emphasizes the vital importance of specific treatment and prevention strategies for these diseases, akin to approaches used for diseases caused by microorganisms or parasites. It also references the insights of Russell regarding the role of vitamins in curing diseases resulting from their deficiency. By shedding light on the impact of unwise feeding practices and the significance of proactive measures, the introduction sets the stage for a detailed exploration of nutritional diseases in various classes of livestock. Throughout the document, a focus on the interplay between nutrition, health, and agricultural practices underscores the critical role of proper nutrition in ensuring the well-being and productivity of farm animals (Payne *et al*, 2013).

Diseases are abnormal conditions or disorders that affect the normal functioning of an organism's body or mind. Numerous variables, such as genetic mutations, infections, environmental conditions, and nutritional inadequacies, can contribute to the development of diseases. A variety of symptoms, such as pain, fever, exhaustion, and organ malfunction, can be present. Diseases can be acute, meaning they develop rapidly and have a short duration, or chronic, meaning they develop slowly and persist over a long period. Proper diagnosis and treatment of diseases are essential for restoring health and preventing further complications. In the context of the article "Nutritional Diseases of Farm Animals," nutritional diseases refer to disorders caused by deficiencies or excesses of essential nutrients in the diet of livestock. These diseases can have significant impacts on animal health and productivity, and their prevention and treatment are critical for ensuring the well-being of farm animals (Phillips *et al*, 2016).

Animal health refers to the overall well-being of animals, including their physical, mental, and emotional states. It encompasses various aspects of animal life, including nutrition, disease prevention and treatment, housing, and environmental conditions. Proper animal health management is essential for ensuring the productivity and profitability of livestock operations, as well as for promoting animal welfare. Animal health management involves monitoring animal health status, identifying and treating diseases promptly, providing adequate nutrition and housing, and implementing measures to prevent the spread of infectious diseases. It also involves ensuring that animals are handled and transported humanely and that their living conditions meet their physiological and behavioral needs. Proper animal health management is critical for maintaining the health and productivity of livestock, as well as for ensuring the safety and quality of animal products for human consumption (Klasing *et al*, 2013).

Feed supplements containing hormones are sometimes used in livestock production to promote growth and improve feed efficiency. Hormonal supplements, such as growth hormones or reproductive hormones, can help enhance muscle development, increase milk production in dairy cows, or improve reproductive performance in breeding animals. However, the use of hormonal supplements in animal feed is a topic of debate due to concerns about potential health risks to both animals and consumers. Regulations regarding the use of hormones in animal feed vary by country, and it

is important for farmers to follow guidelines and regulations set by regulatory authorities to ensure the safe and responsible use of hormonal supplements in livestock production (**Hocquette et al, 2007**).

Importance of proper nutrition in farm animals:

"Nutritional Diseases of Farm Animals" emphasizes the critical importance of proper nutrition in farm animals. Adequate nutrition is essential for the growth, development, and productivity of livestock. Nutritional deficiencies can lead to a range of health problems, including stunted growth, weight loss, and reduced milk or egg production. Animals that receive inadequate nutrition may also be more vulnerable to parasite infestations and other illnesses. Proper nutrition is especially crucial for breeding animals, as undernourishment can lead to reproductive problems and high death rates among offspring. The document highlights the need for a balanced diet that provides all the essential nutrients, including vitamins, minerals, and amino acids. It also stresses the importance of monitoring feed quality and ensuring that animals have access to clean water (**Huffman et al, 1944**).

Overview of nutritional diseases:

As cited in literatures, a comprehensive overview of nutritional diseases that can affect various classes of livestock, including cattle, swine, poultry, and dogs and cats. The document describes the symptoms, causes, and prevention strategies for each disease. The nutritional diseases covered in the document include deficiencies in essential minerals such as calcium, phosphorus, and iron, as well as deficiencies in vitamins such as vitamin A, vitamin D, and the B vitamins. The document also discusses the impact of overfeeding and underfeeding on animal health and productivity. It highlights the importance of recognizing the observable symptoms of nutritional diseases and using laboratory methods to detect deficiencies. The document emphasizes the need for a proactive approach to preventing nutritional diseases, including proper feed management, supplementation, and monitoring of animal health (**Sahoo et al, 2020**).

Rickets:

Most young animals, including calves, foals, piglets, lambs, children, pups, and chicks, are susceptible to rickets. It is distinguished by the improper calcification or hardening of growing bone. The illness is frequently linked to a lack of certain vital nutrients, especially calcium, phosphorus, and vitamin D. The long bones of the legs and ribs, which are growing quickly, are most obviously impacted by rickets (**HuGuoyu et al, 2020**).

Causes and Risk Factors of Rickets:

Rickets primarily stems from a deficiency in essential nutrients, including vitamin D, calcium, and phosphorus, with factors contributing to its development encompassing inadequate sunlight exposure, insufficient synthesis of vitamin D due to a lack of sunlight, poor diet lacking in vital nutrients, malabsorption disorders affecting nutrient absorption in the gastrointestinal tract, and potential genetic factors influencing the metabolism of vitamin D or efficient absorption of calcium and phosphorus. These factors collectively increase the risk of rickets, particularly in young animals with elevated growth requirements.

Symptoms and Effects on Bone Development:

The symptoms of rickets manifest with variability based on the severity of the condition, but common indicators include the enlargement of joints, particularly in the knees and hocks, abnormal curving or straightening of bones impeding normal movement, erosion and roughening of joint surfaces causing pain and discomfort, a stilted gait, and reluctance to move, as well as irregularities in the costo-chondrol junction, known as the rachitic rosary or beaded ribs. These manifestations can significantly impact bone development, leading to weakened bones, deformities, and impaired growth. If left untreated, rickets may result in permanent bone deformities and long-term health complications.

Prevention and Treatment of Rickets:

Prevention and treatment strategies for rickets encompass several key measures. First and foremost is the provision of a balanced diet rich in essential nutrients such as vitamin D, calcium, and phosphorus to fulfill the nutritional requirements of growing animals. Additionally, ensuring adequate exposure to sunlight for natural vitamin D synthesis is crucial. Supplementation with vitamin D, calcium, and phosphorus becomes necessary, particularly for animals at risk of deficiency. Regular veterinary monitoring is essential to detect and address early signs of rickets. In cases where rickets is identified, prompt treatment involving appropriate medications and dietary adjustments is crucial to prevent further bone deformities and foster healthy bone development.

Ketosis (Acetonemia):

Ketosis, also known as acetonemia, is a metabolic disorder that commonly affects dairy cows during early lactation. It is caused by a negative energy balance, where the cow's energy requirements exceed its energy intake, leading to the breakdown of body fat for energy production. This process results in the accumulation of ketone bodies in the blood, which can have toxic effects on the animal's health (**Blaxter et al, 1958**).

Metabolic Disorder in Cattle and Sheep:

Ketosis, also known as acetonemia, is a metabolic disorder that commonly affects dairy cows and sheep, particularly during periods of high energy demand, such as early lactation or late gestation. It is characterized by an imbalance in energy metabolism, leading to the accumulation of ketone bodies in the blood. Ketosis can have significant impacts on the health and productivity of affected animals, affecting milk production in dairy cows and overall performance in sheep.

B. Factors Contributing to Energy Imbalance:

Several factors contribute to the development of ketosis in cattle and sheep, creating an energy imbalance. First, during periods of high milk production or late gestation, there may be a high energy demand that exceeds what the animals can consume, resulting in a negative energy balance. Second, inadequate nutrition, characterized by diets low in energy or lacking essential nutrients, can fail to meet the energy requirements of lactating or pregnant animals, making them more susceptible to ketosis. Third, sudden changes in diet, such as abrupt alterations in feed composition or availability, can disrupt the animal's energy metabolism, increasing the risk of ketosis. Lastly, environmental stressors like heat stress, overcrowding, or transportation can adversely affect feed intake and energy utilization, further contributing to an energy imbalance and the development of ketosis.

Clinical Symptoms and Signs:

Clinical symptoms and signs of ketosis in cattle and sheep encompass various indicators. These include reduced feed intake and diminished milk production in dairy cows, alongside weight loss and poor body condition. One distinctive sign is the presence of sweet or fruity-smelling breath, attributed to the accumulation of ketone bodies. Additionally, affected animals may display lethargy, weakness, and decreased activity. Neurological signs, such as head pressing, circling, or aimless wandering, may become apparent. In severe cases, ketotic animals may exhibit recumbency, progress to a state of coma, or face the risk of death if appropriate treatment measures are not promptly administered.

Management and Prevention:

Effective management and prevention strategies for ketosis in cattle and sheep involve a multifaceted approach. Firstly, providing a nutritionally balanced diet tailored to meet the energy requirements during critical periods, such as lactation or late gestation, is essential. Regularly monitoring the body condition score of animals and adjusting feeding practices accordingly helps prevent energy imbalances. Gradual diet transitions, allowing animals to adapt to new feed sources without disrupting their energy metabolism, are crucial. Stress management plays a pivotal role, involving the minimization of environmental stressors and the creation of a comfortable, low-stress environment to support optimal feed intake and energy utilization. Additionally, regular veterinary monitoring aids in the early detection of ketosis symptoms, facilitating prompt treatment and preventing potential complications.

Grass Tetany (Hypomagnesemia):

Grass tetany, also known as hypomagnesemia, is a metabolic disorder that commonly affects grazing ruminant animals, particularly cattle and sheep. It is characterized by low levels of magnesium in the blood, leading to a range of symptoms and health complications (Wiesner *et al*, 1970).

Causes and Risk Factors of Grass Tetany:

Grass tetany, a disorder affecting cattle, is influenced by various causes and risk factors. Firstly, low magnesium intake from grazing on magnesium-deficient pastures, particularly in early spring when grasses exhibit rapid growth and low magnesium content, serves as a primary contributor to grass tetany. Secondly, elevated levels of potassium and nitrogen in forages can disrupt magnesium absorption, further increasing the risk of grass tetany development. Age and production stage also play a role, with older animals and lactating animals at a heightened risk due to increased magnesium requirements and altered metabolism. Additionally, certain breeds, such as dairy cattle, may exhibit a higher susceptibility to grass tetany owing to genetic predispositions. Understanding these causes and risk factors is crucial for implementing preventive measures and effective management strategies against grass tetany in cattle.

Symptoms and Effects of Grass Tetany:

Grass tetany manifests with distinct symptoms and effects in affected animals. Initial signs involve nervous system abnormalities, including excitability, muscle twitching, and heightened sensitivity to touch or sound. As the condition progresses, animals may display incoordination and a staggering gait, indicative of impaired motor function. In severe cases, grass tetany can lead to tetanic spasms, convulsions, and, if left untreated, eventual death. Notably, some animals may experience sudden death without displaying preceding clinical signs. Recognizing these symptoms is crucial for prompt identification and intervention, as grass tetany can have rapid and severe consequences on the well-being of affected livestock.

Prevention and Treatment of Grass Tetany:

Preventing and treating grass tetany involves several key measures. Firstly, magnesium supplementation through mineral mixes or oral drenches is crucial to prevent grass tetany in at-risk animals. Ensuring a balanced nutrition by providing access to forages with adequate magnesium levels and a well-balanced mineral content is essential. Effective pasture management strategies, including measures to enhance magnesium levels and reduce factors interfering with magnesium absorption, such as excessive potassium and nitrogen, are critical. Additionally, prompt veterinary

intervention is essential for diagnosing and treating grass tetany, often involving intravenous magnesium administration and providing supportive care for affected animals. This comprehensive approach aims to mitigate the risk of grass tetany and address the condition promptly when detected.

Selenium Deficiency

Importance of Selenium in Animal Nutrition:

Selenium is an essential trace mineral that plays a crucial role in animal nutrition due to its involvement in various physiological processes, including antioxidant defence, immune function, thyroid hormone metabolism, and reproductive health. Selenium acts as a cofactor for selenoproteins, which help protect cells from oxidative damage and regulate immune responses. Inadequate selenium intake can lead to selenium deficiency, resulting in various health issues in animals, such as white muscle disease and impaired immune function (Meijer *et al*, 2006).

White Muscle Disease and Its Symptoms:

White muscle disease, also recognized as nutritional myodegeneration, is linked to selenium deficiency, predominantly affecting ruminants like cattle, sheep, and goats. The condition is characterized by degenerative changes in the muscles, resulting in weakness, stiffness, and impaired movement. Common symptoms encompass muscle weakness and stiffness, particularly in the hindquarters and neck, along with reluctance to move, lameness, and an abnormal gait. In severe cases, animals may exhibit respiratory distress and difficulty breathing. Additional indicators include reduced growth rates, poor weight gain, and decreased milk production. Acute cases may also present cardiac abnormalities, potentially leading to sudden death. Identifying and addressing selenium deficiency is crucial for the prevention and management of white muscle disease, emphasizing the importance of balanced nutrition and selenium supplementation in affected animal populations.

Geographic Considerations:

The prevalence of selenium deficiency and white muscle disease in animals is often influenced by geographic factors, including soil selenium levels and forage selenium content. Regions with selenium-deficient soils, such as certain areas in the United States, Canada, and parts of Europe, are more prone to selenium deficiency in livestock. Animals grazing on selenium-poor pastures or consuming feeds with low selenium content are at higher risk of developing selenium deficiency-related conditions.

Selenium Supplementation and Prevention:

To address selenium deficiency and prevent white muscle disease in animals, various supplementation strategies can be employed. Firstly, providing animals with selenium-fortified feeds, such as commercially available supplements or mineral mixes containing organic or inorganic forms of selenium, is a common approach. Additionally, injectable selenium formulations can be administered under veterinary supervision to rapidly correct selenium deficiency in affected animals. Soil and forage management play a pivotal role, involving soil tests to assess selenium levels and implementing amendments or fertilizers to enhance selenium content in pastures and forages. Regular veterinary monitoring, including assessments and blood tests, is essential to detect early signs of selenium deficiency, enabling the implementation of timely supplementation protocols to prevent health issues in livestock. This comprehensive approach ensures a well-rounded strategy for selenium supplementation and mitigating the risk of white muscle disease in susceptible animal populations.

Vitamin A Deficiency:

Role of vitamin A in animal health:

Vitamin A plays a crucial role in animal health, with its deficiency leading to various manifestations affecting vision, reproduction, and immune function. It is essential for maintaining healthy eyesight, reproductive function, and a robust immune system in farm animals.

Manifestations of deficiency:

A vitamin A shortage can cause night blindness, scaly hoofs, keratinization of the cornea, excessive lachrymation, breathing difficulties, infertility, and increasing weakening. Severe circumstances may result in death.

Importance for vision, reproduction, and immune function:

Vitamin A is important for vision, reproduction, and immune function in farm animals. It is necessary for maintaining healthy eyesight, especially in low-light conditions. It also plays a crucial role in the development and maintenance of reproductive tissues and is essential for proper immune function.

Sources and prevention strategies:

Sources of vitamin A include carotenoids found in plants, such as beta-carotene, which is abundant in green forage of all kinds. In order to ensure optimal intake, prevention techniques include providing animals with appropriate nutrition, such as winter or dry-lot feeding seasons when they are fed high-quality legume or grass hay or silage of the current season's crop. Additionally, unless the ration is supplemented with carotene-rich feeds, it is best to avoid providing carotene-deficient feeds for a lengthy period of time (Noordhuizen *et al*, 1985).

Copper Deficiency:

Copper deficiency in farm animals can lead to various health issues, including swayback, warble, or enzootic ataxia in lambs. Degeneration of the myelin sheath around nerve tracts, especially in the spinal cord, is a potential consequence of this disorder, which affects the neurological system. Giving access to salt licks containing copper sulfate to expectant ewes can aid in preventing swayback in lambs. However, it's important to note that while copper is essential in small quantities for preventing deficiency, it can be poisonous in large amounts. Therefore, careful management of copper supplementation is crucial to avoid toxicity.

Essential functions of copper in animals:

Copper is an essential mineral for animals, playing a crucial role in various physiological functions, including the formation of connective tissue, iron metabolism, and the production of melanin. It is also involved in the proper functioning of the immune system and the nervous system.

Consequences of copper deficiency:

Copper deficiency in farm animals can lead to various health issues, including swayback, warble, or enzootic ataxia in lambs. This condition affects the nervous system and can result in degeneration of the myelin sheath of nerve tracts, particularly in the spinal cord. Copper deficiency can also lead to anemia, poor growth, and reproductive failure.

Copper supplementation and dietary consideration:

Copper supplementation is necessary to prevent copper deficiency in farm animals. However, it's important to note that while copper is essential in small quantities for preventing deficiency, it can be poisonous in large amounts. Therefore, careful management of copper supplementation is crucial to avoid toxicity. Copper sulfate is commonly used as a supplement, and it can be added to the animal's diet or provided through salt licks. It's also important to consider the dietary factors that can affect copper absorption, such as the presence of other minerals like molybdenum and sulfur, which can interfere with copper absorption.

Iodine Deficiency:

Iodine deficiency in farm animals can lead to various health issues, including goiter and reproductive problems. In domestic animals, enlargement of the thyroid gland is a common sign of iodine insufficiency. Additionally, it may disrupt reproductive processes, resulting in the birth of frail, malformed children who frequently do not survive. Animals that don't get enough iodine may have longer than usual gestations, and their young may be sickly or stillborn. Therefore, ensuring adequate iodine intake is crucial for the reproductive health and overall well-being of farm animals.

Importance of iodine for thyroid function:

Iodine is crucial for thyroid function in animals. It is a key component of thyroid hormones, such as thyroxine and triiodothyronine, which play a vital role in regulating metabolism, growth, and development. Thyroid hormones are essential for maintaining normal physiological functions in animals, including reproduction, growth, and energy metabolism.

Effects of iodine deficiency on animal:

Iodine deficiency in farm animals can have significant effects, including enlargement of the thyroid gland, known as goiter. Additionally, it can lead to reproductive issues, such as longer gestation periods, stillbirths, and the birth of weak or deformed offspring. These effects can have detrimental impacts on the overall health and productivity of the animal population.

Prevention through iodized salt and dietary measures:

Prevention of iodine deficiency in farm animals can be achieved through the use of iodized salt and dietary measures. Iodized salt containing a specific percentage of potassium iodide can be provided to animals to ensure adequate iodine intake. Additionally, dietary measures should consider the iodine content of feed and the potential for antagonistic factors, such as diets high in calcium or fat, which may affect iodine absorption. Proper supplementation and monitoring of iodine levels in the diet are essential for preventing iodine deficiency in farm animals.

Conclusion:

In conclusion, nutritional deficiencies pose significant threats to the health and productivity of farm animals. Proper supplementation and vigilant monitoring of mineral levels in the diet, coupled with regular veterinary consultation, are imperative for averting nutritional diseases. Key minerals like copper, manganese, and iodine play crucial roles in various physiological functions, and their deficiencies can result in a spectrum of health issues in farm animals. Regular health monitoring and collaboration with veterinarians are vital for identifying and addressing nutritional deficiencies. Veterinary professionals offer guidance on appropriate supplementation and dietary adjustments to ensure optimal health and productivity. Fundamental strategies for preventing nutritional diseases include furnishing a balanced diet that meets nutritional requirements, monitoring mineral levels, and supplementing as needed. Moreover, maintaining clean and hygienic living conditions through proper management practices is essential for preventing disease spread and

promoting animal well-being. Implementing these strategies aligns with the work of Scrimshaw et al. (1964) and contributes to safeguarding the health and productivity of farm animal populations.

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