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Ramiro E. Toribio

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Francisco J. Mendoza, Ramiro E. Toribio, and Alejandro Perez-Ecija

The donkey evolved under harsh and arid environmental conditions, developing unique energy-efficiency traits, with an efficiency to rapidly mobilize fat in situations of increased energy demands or when food is scarce. This evolution has led to an inherent predisposition of donkeys to obesity, dyslipidemias, insulin dysregulation/metabolic syndrome, pituitary pars intermedia dysfunction, and endocrinopathic laminitis. Marked differences have been described in hormone dynamics and testing protocols for the diagnosis of these endocrine and metabolic diseases in donkeys compared with horses, underlining the necessity of a species-specific approach in order to avoid misdiagnosis, unnecessary or inadequate treatments, and additional costs.

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Alexandra K. Thiemann and Rebekah J.E. Sullivan

A review of common gastrointestinal disorders of donkeys and mules is presented. Clinically relevant aspects of donkey behavior, anatomy, and physiology are highlighted. Diagnosis, management, and treatment of conditions affecting the gastrointestinal tract from stomach to rectum, including liver and pancreas, are discussed.

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| <b>Clinical Pathology of Donkeys and Mules</b> | <b>433</b> |
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Erin L. Goodrich and Erica Behling-Kelly

Given the stoic nature of donkeys and their hybrids, it is important to consider the significance of diagnostic testing modalities that can provide objective health status information beyond the basic physical examination findings. However, clinical pathology assays are also fraught with significant limitations because the results for donkeys, mules, and hinnies can be difficult to interpret, and transference of data from the horse is not always applicable. This article presents considerations for sample collection, storage, analysis, and interpretation strategies for clinical pathology testing of donkeys and their hybrids based on the limited information available in the literature.

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Margaret M. Brosnahan

The genus *Equus* is made up of donkeys, horses, and zebras. Despite significant variation in chromosome number across these species,

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| <p>interspecies breeding results in healthy, although infertile, hybrid offspring. Most notable among these are the horse–donkey hybrids, the mule and hinny. Donkeys presently are used for everything from companion animals to beasts of burden. Although closely related from an evolutionary standpoint, differences in anatomy and physiology preclude the assumption that they can be treated identically to the domestic horse. Veterinarians should be aware of these differences and adjust their practice accordingly.</p>                                                                                                                                                                        |                   |
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| <p>The domestic donkey is a unique equid species with specific nutritional requirements. This article examines the importance of feeding strategies that mimic the donkey's natural environment using poor nutritional quality fibers and access to browsing materials. The relationship between nutrition and health is examined and practical approaches to the healthy and sick donkey are discussed.</p>                                                                                                                                                                                                                                                                                                 |                   |
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| <p>Donkeys and mules have been critical to the development of human civilization, since being domesticated some 6000 years ago. However, they suffer from being undervalued or ignored by development agencies and animal protection nongovernmental organizations. Where they are recognized as affecting agriculture and the economy it is often because they are seen as being either invasive pests or an anachronism in the developing countries of the twenty-first century. Even in the wealthier societies of the world, donkeys suffer from ignorance about their proper management or a booming industry in health care products based on donkey skin gelatin and milk byproducts.</p>             |                   |
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| <p>Skin disease in donkeys is less common than in horses, but is easily overlooked. Little published material exists on this important area of equine medicine. Skin tumors continue to challenge veterinarians working with donkeys. This article outlines the main disease entities that the author has encountered, although there are many other diseases and disorders that occur in different parts of the world that are not yet appreciated. When investigating a skin disease, a logical and comprehensive clinical approach should always be made; many conditions are similar in clinical presentation or are complicated by comorbidity or secondary infection, infestation, or self-trauma.</p> |                   |
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| <p>The number of donkeys in the world may not be increasing but awareness of their use and concern for welfare and pain recognition and treatment are receiving increasing veterinary interest. Therefore, accurate information</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |

about anesthesia and analgesia in donkeys and mules is important to more equine practitioners. This review highlights the current knowledge on various anesthetic and analgesic approaches in donkey and mules. The authors emphasize that there is still much information that is not available about donkeys and mules; in many circumstances, the clinician must use available equine information to treat the patient, while monitoring for differences in response.

### **Dental Disorders of Donkeys**

529

João B. Rodrigues and Gemma Lilly

Research and clinical understanding of equine dentistry has progressed in recent years; however, specific knowledge about donkey dentistry is lacking. This article intends to revise unique anatomic features of the head and oral cavity of donkeys, as well as how to correctly examine, diagnose, prevent, and/or treat dental pathology, allowing for a better comprehension of oral and dental disorders affecting these animals throughout their life. It also emphasizes that these disorders need to be taken into account when assessing the welfare of donkeys.

### **Clinical Evaluation and Preventative Care in Donkeys**

545

Elena Barrio, Karen J. Rickards, and Alexandra K. Thiemann

Clinical evaluation and preventative care in donkeys should follow similar guidelines as for horses. There are species-specific differences due to the desert-adapted physiology of the donkey. Donkeys are mainly used as pack animals, companions and for production of meat or milk - they may be kept well into old age. Diseases often present late or may go unrecognized leading to poor welfare and quality of life. Basic knowledge of nutrition, blood values, pharmacology and common disease recognition will help veterinarians improve the health and welfare of donkeys.

### **Respiratory Disorders of the Donkey**

561

Karen J. Rickards and Alexandra K. Thiemann

Donkeys suffer from the same respiratory diseases as horses; however, owing to their nonathletic nature many conditions can present in a more advanced state before becoming clinically apparent. Anatomically, their respiratory tract is similar to the horse, with certain species-specific differences that are important to be aware of. Often donkeys do not receive the same level of routine care as horses, so many are not vaccinated against respiratory pathogens such as influenza or herpesviruses. Donkeys can act as a reservoir for certain infectious and parasitic respiratory diseases and the interpretation of diagnostic tests needs to be carried out with caution.

### **Donkey and Mule Behavior**

575

Amy Katherine McLean, Francisco Javier Navas González, and Igor Federico Canisso



Video content accompanies this article at <http://www.vetequine.theclinics.com>.

Donkeys and mules often are misunderstood because of their behavioral differences compared with horses. Working with these animals requires

more patience and ability to notice the slightest changes in behavior to diagnose disease. Mules and donkeys form strong bonds and trust with familiar people and other equids. Training mules and hinnies from an early age is key to modifying behavior and acceptance of unfamiliar people. Reproductive behavior is different from that of horses and requires more patience when collecting jacks. Practitioners working with mules and donkeys should take a methodological approach and get to know the animal before performing examinations.

**Clinical Pharmacology in Donkeys and Mules**

**589**

Francisco J. Mendoza, Alejandro Perez-Ecija, and Ramiro E. Toribio

Donkeys and mules show several pharmacodynamic and pharmacokinetic idiosyncrasies that have to be fully considered by any clinician dealing with these species. Because they possess an increased metabolic rate and cellular water content compared with horses, higher doses (or shorter dosing intervals) are usually recommended for those drugs where pharmacologic studies have been performed. Nonetheless, owing to the lack of species-specific information, this assumption cannot be arbitrarily applied. Thus, when a drug protocol published for horses is extrapolated to a donkey or a mule, a close monitoring is required to detect any secondary effect or subdosing.

**Key Aspects of Donkey and Mule Reproduction**

**607**

Igor Federico Canisso, Duccio Panzani, Jordi Miró, and Robyn E. Ellerbrock

Donkeys are nonseasonal, polyestrous, territorial, and nonharem breeders. Although there are many similarities between horses and donkeys, there are also reproductive features that differ, from the longer cervix in the jenny to spermatogenic efficiency in the jack. Mules display reproductive cyclic activity but are rarely fertile. Frozen donkey semen has high pregnancy rates in mares, but lower rates in jennies. This article reviews key aspects of donkey and mule reproductive physiology, reproductive medicine, and assisted reproductive techniques that are useful for practitioners offering assisted reproductive techniques, and also for practitioners with the occasional client with a basic reproductive question.

**Hoof Disorders and Farriery in the Donkey**

**643**

Alexandra K. Thiemann and Luke A. Poore

This article provides a review of hoof anatomy and care in donkeys and mules. Hoof disease is a major cause of poor welfare and mortality globally. Problems associated with hoof disease are discussed in the context of behavior, diet, treatment, and prevention. The most common conditions encountered are discussed, including laminitis, the overgrown unbalanced hoof, white line disease, flexural deformities, and other significant issues. Differences between donkey and horse hoof anatomy are described.