Equines as Experimental Models: A Review of Their Use in Therapy, Antivenom Production, and Sports

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Minireview Article

ABSTRACT

The horse is a large, strong, docile, and easily handled animal with therapeutic qualities, making it an ideal experimental model for various studies. Given this, the aim of this review is to identify the criteria for selecting horses as an experimental model in research related to equine-assisted therapy (hippotherapy), antivenom production, and equestrian sports. To achieve this, a

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bibliographic search was conducted in the Google Scholar database using the following keywords: "selection," "horses," "equine-assisted therapy," "equestrian sports," and "antivenom." Inclusion criteria focused on selecting articles that provided relevant and insightful information on these search terms. The analyzed studies demonstrated that equine-assisted therapy is an effective therapeutic approach for the rehabilitation of individuals with disabilities, fostering improvements in motor, cognitive, and emotional aspects. In selecting horses for equine-assisted therapy, motor, morphological, and behavioral criteria were considered to ensure both the safety and effectiveness of treatment. For antivenom production, large horses were preferred due to their greater blood volume, which enables better tolerance during plasma collection. Lastly, in selecting horses for equestrian sports, it was noted that each breed possesses specific skills suited to different sport categories; thus, criteria such as obedience, physical endurance, and agility were assessed for each horse.

Keywords: Equestrianism; equine; hippotherapy; hyperimmune plasma.

1. INTRODUCTION

Horses play a crucial role in our society, particularly after the domestication process, which introduced changes in various behavioral and physiological aspects. They are large, affectionate, and easy to handle, capable of forming bonds with humans (Robacher et al., 2003). Horses have evolved alongside human development, being utilized for sports and in rural areas. They are also used in therapeutic settings, aiding in emotional and physical treatments (Oliveira et al., 2011).

Equine therapy is a therapeutic method aimed at the recovery of individuals with disabilities and specific needs. Its goal is to help participants develop balance, muscle tone, strength, body awareness, coordination, attention, and other basic bodily needs. In equine therapy, horses are used to achieve motor, cognitive, and emotional objectives (Oliveira et al., 2011). Regarding their profile, horses must be evaluated to participate in equine therapy sessions and trained to effectively contribute to the treatment of practitioners.

Antivenom serum is a pharmaceutical used to treat snake envenomations. In Brazil, this medication is essential for the rural population, who have more contact with snakes. On average, snake bites occur over twenty thousand times a year, resulting in approximately one hundred fatalities annually (Ministry of Health (BR), 2024). The process of producing antivenom serums is complex; although it is a medication, it is a biological product produced in stages, including the breeding and management of these animals for venom collection, the use of technology for biochemical processes to fractionate hyperimmune plasma, and the final product formulation (Lalloo and Theakston, 2003; Burnouf et al., 2004).

Sports activities demand high physical effort from horses due to increasing competitiveness, often leading to stress and severe training regimens, which can result in injuries among these athletes (Resende, 2005). A competent team of veterinarians, trainers, and caretakers must work together to maximize the horse's performance, pushing them to their limits while remaining within each horse's capacity. Brazil has witnessed significant growth in the Three Barrels competition, with the main objective of achieving optimal performance from horses for competition. During competitions, horses are subjected to extreme physical demands, but these efforts are brief (Xavier, 2002). One of the primary sources of income for horse owners is their competitive performance. Competitive horses involved in equestrian sports, such as show jumping, attract special attention and interest, especially since it is an Olympic discipline. This requires a more in-depth evaluation of each horse's abilities, aiming for the appropriate intensity of each exercise and their capabilities according to their training (Thornton, 1985).

Recognizing the diverse applications of horses in today's society, the objective of this review is to outline the criteria for selecting horses as experimental models in research involving individuals in equine therapy, antivenom production, and equestrian sports.

2. METHODOLOGY

To develop this literature review on the use of horses as experimental models, bibliographic research was conducted using the Google Scholar database. The search was guided by

specific keywords: "selection," "horses," "equine-assisted therapy," "equestrian sports," and "antivenom." As inclusion criteria, articles were selected that provided relevant information on the selection of horses for experimental applications, particularly in the fields of equine-assisted therapy, antivenom production, and equestrian sports.

The goal of this careful article selection was to ensure a comprehensive and evidence-based analysis of the key factors in choosing horses as experimental models. This approach allowed for the gathering of information that contributes to understanding the requirements necessary for the safe and effective use of horses in each of these areas, considering management needs, physical characteristics, and the therapeutic or athletic potential of these animals.

3. RESULTS AND DISCUSSION

3.1 Selection of Horses in Equine Therapy

In equine therapy, several factors are of utmost importance for selecting the horses that will perform this function. Aspects such as motor, morphological, and behavioral criteria are essential for the choice of these individuals. Duarte et al. (2015), in their work on the selection process of horses for therapeutic activities, utilized the following morphological evaluation criteria: length of the lumbosacral region, length of the pastern, angulation, height of the back, alignment of the withers and croup, neck conformation, and height at the withers. Motor aspects considered included the kinematics of the walk. Behavioral aspects assessed included docility, obedience to commands, and scores for desensitization to tactile, auditory, and visual stimuli.

The characteristics that led to the exclusion of individuals from selection included the presence of a pacing gait and behavioral deviations such as biting and kicking. The horses that underwent the selection process exhibited a regular lumbosacral region, a medium-length pastern, aligned withers and croup, and an average height at the withers of 1.50 meters. Additionally, obedient and docile behavior were also characteristics of the approved individuals.

Similarly, Pereira et al. (2018), in their research on the conditioning of horses for their maintenance in equine therapy, also used criteria for selecting evaluated individuals that included animals with diverse gaits, a docile temperament, and an average height of 1.43 meters.

3.2 Selection of Horses for Antivenom Production

In antivenom production, large animals are generally used to provide a substantial volume of product in each production cycle. The most commonly used species are horses (Equus caballus) and sheep (Ovis aries) (Theakston and Warrell, 1987). In Brazil, horses are used as an experimental model for antivenom production. According to the Butantan Institute (Butantan, 2021), horses have the size and strength required to tolerate the entire production process well. The larger the individual, the more blood circulates through their body, increasing the amount of plasma, which enhances serum production. Additionally, horses are calm, easy to control, and more easily trained for the tasks required by scientists.

Parra (2005), evaluating blood count variation in production horses, used 20 serum-producing horses in his research, of no specific breed, weighing an average of 400 kg, and clinically deemed healthy and fit for the serum production process.

Monteiro (2020), in his study assessing hematological parameters in serum-producing horses, used 100 healthy, non-breed-specific horses, aged between seven and twenty years. The individuals underwent a veterinary evaluation, where each was weighed, and their body condition score was assessed on a scale of 1 to 5 (1 – emaciated; 2 – thin; 3 – ideal weight; 4 – overweight; 5 – obese), with animals scoring below 2 being excluded from the study.

Souza (2019) used nine healthy, non-breed-specific horses weighing approximately 360 kg to 570 kg as experimental models in his study of base immunization with *Bothrops* antigen in serum-producing horses, aiming for an immune response.

All researchers emphasized weight and the health of the individuals as key criteria for selecting them as serum producers.

3.3 Selection of Horses for Equestrian Sports

In equestrian sports, certain horse breeds exhibit greater aptitude and skill for specific categories,

Table 1. Horse breeds most commonly used in each category

Categories	Most Commonly Used Breeds
Show Jumping	Lusitano, Andalusian, Westphalian, Brazilian Sport Horse, Belgian Warmblood, Anglo-Arab.
Dressage	Brazilian Sport Horse, Thoroughbred, Andalusian, and Lusitano.
Complete equestrian	Anglo-Arab, Arabian Thoroughbred, Brazilian Sport Horse, and Thoroughbred.
Endurance	Anglo-Arab, Arabian Thoroughbred, and Arabian Cross.
Driving	Breton, Percheron, Arabian, Lusitano, and Andalusian.
Vaulting	Brazilian Sport Horse, Breton, Andalusian, and Lusitano.
Barrel Racing	Quarter Horse, Appaloosa, and Paint Horse.

Source: Authors, 2024.

making them the preferred choice for practitioners. Factors such as obedience, agility, and physical constitution are of utmost importance. According to the Brazilian Equestrian Confederation (CBH), there are 8 categories: show jumping, dressage, eventing, endurance, driving, vaulting, and barrel racing.

Santos (2006) conducted research with 17 Brazilian Sport Horses participating in show jumping, focusing on the variation of hematological and biochemical parameters. Similarly, Soares (2012), in his evaluation of tests for measuring the physical conditioning of show jumping horses, worked with 16 Brazilian Sport Horses.

Santiago et al. (2013) studied 16 Brazilian Sport Horses, assessing hematology and serum biochemistry of horses in eventing during training. Nothaft (2022), in her research on eventing competition horses, worked with 18 Brazilian Sport Horses.

Sala et al. (2012) conducted research with four Quarter Horses participating in the barrel racing modality, as did Barbosa et al. (2016), who evaluated 16 Quarter Horses undergoing training in the same discipline.

The Quarter Horse breed is the most commonly used in the barrel racing category due to its ability to accelerate rapidly over the first quarter of a mile (402 meters) in a race, surpassing the acceleration of horses of any other breed (2006), making it ideal for events that demand speed.

The Brazilian Sport Horse breed was developed in Brazil with the specific goal of producing horses for equestrian sports. According to the Brazilian Association of Sport Horse Breeders (ABCCH), this breed is a mix of over 20 different breeds, with origins ranging from Europe to Latin America. Some of these breeds include Anglo-European, Bavarian, Bayern, Friesian, Hessen, Argentine Warmblood, Belgian Warmblood, Danish Warmblood, Uruguayan Warmblood, Trakehner, Württemberg, Zangersheide, and Zweibrücken, which contribute to making this breed an excellent choice for equestrian sports.

4. CONCLUSION

Considering the observed aspects, each function to be performed requires different selection criteria. Horses used in equine therapy are chosen based on their morphological evaluation, with particular emphasis on withers height, diversity in gait, and behavior. In antivenom production, the health and weight of the animals are the most important criteria due to the need for plasma production. For equestrian sports, it was noted that certain breeds are preferred for specific modalities, making these breeds the most desirable in research involving competition horses.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below

1. The generative AI technology used was ChatGPT, which is based on large language models (LLMs) developed by OpenAI. The applied version is the most recent in the series, belonging to the GPT-4 (Generative Pre-trained Transformer 4) family. All of the generative artificial intelligence behind ChatGPT was developed and trained by OpenAI.

2. The technology was used strictly to assist in the translation of the manuscript from Brazilian Portuguese to English for the purpose of publication in the current journal. After the translation, the text was reviewed again by team members to identify and correct any potential translation errors.

3. The input prompt used was: "Translate the text from Portuguese to English, without altering the meaning of the sentences".

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Barbosa, J. P., Denadai, D. S., Gerardi, B., Pereira, M. A., Chaves, A. A., Gomide, L. M. W., et al. (2016). Endoscopic evaluation of the airways, gas profile, electrolytes and acid-base balance in horses undergoing three-barrel training. *Arquivos Brasileiros de Medicina Veterinária e Zootecnia*, 68, 1152-1158.

Burnouf, T., Griffiths, E., Padilla, A., Seddik, S., Stephano, M. A., & Gutiérrez, J. M. (2004). Assessment of the viral safety of antigens fractionated from equine plasma. *Biologicals*, *32*(3), 115-128.

Butantan. (2021). Why are only horses used for serum production? *Butantan Portal.* Available from https://butantan.gov.br/bubutantan/por-que-sobre-cavalos-sao-usados-para-a-producao-de-soros

Duarte, A. C. D. A., Oliveira, K. D., Araújo, M. S., Oliveira, G. A. C., & Kai, K. S. S. (2015). Selection process for horses in therapeutic activity: Activity of the UNESP/Dracena equine therapy project. In *UNESP University Extension Congress*. São Paulo State University (Unesp). 1-4

Lalloo, D. G., & Theakston, R. D. G. (2003). Snake antivenoms: Antivenoms. *Journal of Toxicology: Clinical Toxicology*, *41*(3), 277-290.

Ministry of Health (BR), (2024). Health Surveillance Secretariat, Epidemiological Surveillance Department, General Coordination of Communicable Diseases, Surveillance Coordination of Vector-Borne Diseases and Anthropozoonoses. *History of snakebite* [PDF]. Retrieved from www.portal.saude.gov.br/portal/arquivos/pdt/historico-ofidismo.pdf

Monteiro, T. K. (2020). Evaluation of hematological parameters in seroproducing horses undergoing automated plasmapheresis at the Butantan Institute. São Paulo: Instituto Butantan.

Nielsen, B. D., Turner, K. K., Ventura, B. A., Woodward, A. D., & O'Connor, C. I. (2006). Racing speeds of quarter horses, thoroughbreds and Arabians. *Equine Veterinary Journal*, 38(S36), 128-132.

Nothaft, I. T. (2022). Effect of training interruption on the physical conditioning of horses in full riding competitions. São Paulo: University of São Paulo.

Oliveira, E., Rodrigues, L., Ceacero, P., Teodoro, I., Oliveira, F., & Teixeira, R. (2011). Equine therapy: The use of the horse in therapeutic practices. In *IV IFMG Science and Technology Week*.

Parra, A. C. (2005). Variations in blood crasis during hyperimmunization and after bleeding and plasmapheresis in horses producing anti-crothalic hyperimmune serum [PhD thesis]. University of São Paulo.

Pereira, R. V. G., Villanova, D. F. Q., Tafuri, N. M. A., Minighin, D. C., Carvalho, W. T. V., & Baumgratz, J. L. (2018). Conditioning the horse for its maintenance in equine therapy. *Pubvet*, 12, 131.

Resende, A. M. (2005). Myositis in the athletic horse. In *II Athletic Horse Symposium/IV Horse Week. Proceedings... II Symposium on the Athlete Horse – IV Horse Week*. Federal University of Minas Gerais, Belo Horizonte; 56-75.

Robacher, M. C. (2003). Physiotherapeutic analysis of gait in spastic hemiplegic patients using hippotherapy. *Equine Therapy – Magazine of the National Association of Equine Therapy (ANDE-BRASIL)*, 5(7), 8.

Sala, L. C. C., Elui, M. C., & Jardim, M. C. (2012). Thermographic evaluation of the pelvic muscles of horses in three-barrel sports. *Pubvet*, 6.

Santiago, J. M., Almeida, F. Q., Silva, L. L. F., Miranda, A. C. T., Azevedo, J. F., Oliveira, C. A. A., & Carrilho, S. S. (2013). Hematology and serum biochemistry of horses in full riding competition in training. *Arquivos Brasileiros de Medicina Veterinária e Zootecnia*, 65, 383-392.

Santos, V. P. D. (2006). Effect of exercise protocol on hematological and biochemical variables in jumping horses. São Paulo: University of São Paulo.

Soares, O. A. B. (2012). Evaluation of tests to measure the physical conditioning of jumping horses. São Paulo: University of São Paulo.

Souza, R. D. J. (2019). Basic immunization with *Bothrops* genus antigen in seroproducing horses aiming for an immunological response. São Paulo: Instituto Butantan.

Theakston, R. D. G., & Warrell, D. A. (1987). Antivenoms: A list of hyperimmune sera currently available for the treatment of envenomation by bites and stings. *Toxicology*, 21, 739-752.

Thornton, J. R. (1985). Exercise testing. *Veterinary Clinics of North America: Equine Practice*, 1(3), 573-595.

Xavier, I. (2002). Detection of diseases of the locomotor system through physical examination in vaquejada horses. Mossoró: Mossoró Higher School of Agriculture.

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