Applicability of Whole-Body Vibration Exercises as a new tool in Veterinary Medicine

Mayara V. F. Gomes,1 Ivan F. C. Santos,* Sheila C. Rahal,1 Bruna M. Silva1

Abstract

Whole body vibration (WBV) is generated by devices which produce oscillations - vibratory platforms. Several benefits of the use of vibrating platforms have been described, such as increase of muscle strength, improvement of exercise performance and improvement of balance and functional mobility. Although WBVE has been studied and used in many applications in human subjects, there are only a few studies published about whole-body vibration as a therapeutic modality in animals. The present review aimed to summarize the findings of original articles about the effects of WBVE on animals. Veterinary Medicine articles published in international journals were selected, and small animals, large animals, and wild animals were included. Few studies related to WBVE were identified, and fewer publications still about wild animals. The use of wrong vibration parameters, including vibration intensity, exposure time, amplitude, and acceleration also causes adverse effects in animals. More studies are needed to determine an adequate protocol and the efficacy of whole body vibration in each species, as well as to explore other therapeutic applications.

Keywords: Vibrating platform; Mechanic vibrations; Veterinary.

Resumen

Aplicabilidad de los Ejercicios de Vibración de Cuerpo Entero como nueva herramienta de la Medicina Veterinaria

Las vibraciones de cuerpo entero son generadas por dispositivos capaces de generar oscilaciones - plataformas vibratorias. Diversos beneficios del uso de plataformas vibratorias tienen sido descritos, como aumento de la fuerza muscular, mejoría del desempeño físico y mejora del equilibrio y la movilidad funcional. La vibración de cuerpo entero ha sido estudiada y usada en muchas aplicaciones en seres humanos, existiendo apenas algunos estudios publicados sobre vibración de cuerpo entero como modalidad terapéutica en animales. La presente revisión tuvo como objetivo resumir los resultados de artículos originales que investigaron los efectos de la vibración de cuerpo entero en animales. Foran utilizados artículos publicados en revistas internacionales en Medicina Veterinaria, y fueron incluidos pequeños animales, animales de grande porte y animales salvajes. Pocos estudios relacionados al uso de vibración de cuerpo entero fueron identificados y las publicaciones sobre animales salvajes estuvieron escasas. El uso de parámetros de vibración errados, incluyendo la intensidad de vibración, tiempo de exposición, amplitud y aceleración, también causa efectos adversos en animales. Más estudios son necesarios para determinar un protocolo adecuado y a la eficacia de la vibración de cuerpo entero en cada especie, como también para explorar otras aplicaciones terapéuticas.

Descritores: Plataforma vibratória; Vibrações mecânicas; Veterinária.
Introduction

Whole body vibration (WBV) has been studied for a few decades. In 1970’s the National Institute of Occupational Safety and Health in the USA identified some of the types of WBV and found in several work situations potential health and safety implications of industrial vibration exposure. In the following decades many studies have been done to understand the effects of WBV. And it was especially during the 2000’s that therapeutic benefits of whole body vibration exercises (WBVE) started to be researched.

Several different benefits of the use of vibrating platforms have been described, such as improvement of exercise performance, an increase in muscle strength, and improvements in balance and functional mobility. Review papers and systematic reviews with or without meta-analyses have been used to compare WBVE studies and suggest the best protocols to achieve different benefit to each patient. Although WBVE has been studied and used in many applications in human subjects, there are only a few studies published with whole-body vibration as a therapeutic modality in animals. The present review aims to summarize the findings of original articles that investigate effects of WBVE on animals.

There are three main types of oscillating vibrating platforms that allow the transmission of these mechanical vibrations. They differ according to the movement of their base, which may have alternating or vertical displacement (synchronous or triplanar). In addition, in order to establish the intervention protocol through mechanical vibrations, it is necessary to understand all variables, such as physical parameters, exposure time, and position on the oscillating vibrating platform.

Whole-body vibration exercise in animals

A study with seven healthy adult horses conducted by Carstanjen and others analysed the effects of WBVE on clinical parameters and blood values after a single WBVE session (Table 1). Heart and respiratory rate were measured by auscultation and venous blood samples were obtained before and immediately after the WBVE session. A statically significance decrease in serum cortisol and creatine kinase values were observed, which may relate to a low-stress condition and low intensity exercise response, respectively. A 10 minutes WBVE session was well tolerated in adult horses and did not cause any sign of measured discomfort.

Another study evaluated the renal resistivity index for determinar un protocolo adecuado y la eficacia de la vibración de todo el cuerpo en cada especie, así como para explorar otras aplicaciones terapéuticas.

**Palabras clave**: Plataforma vibratoria; Vibraciones mecánicas; Veterinaria.

<table>
<thead>
<tr>
<th>Study</th>
<th>Subjects</th>
<th>Duration</th>
<th>Parameters</th>
<th>Study design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carstanjen et al.</td>
<td>7 healthy adult horses, 4 geldings, 3 mares, age range from 8-27 years</td>
<td>Single session (10 minutes)</td>
<td>15 to 21Hz, for 10 minutes</td>
<td>Horses were standingstood on four separate platforms; heart and respiratory rate were measured and blood samples were collected before and immediately after a WBVE session.</td>
</tr>
<tr>
<td>Freire et al.</td>
<td>10 intact healthy dogs, 6 males and 4 females, age range from 1.7-3.5 years and weight range from 20.5-41 kg; Dog breeds were Pit Bull (n = 5), Labrador retriever (n = 3), Rottweiler (n = 1) and one crossbreed</td>
<td>Single session (15 minutes)</td>
<td>30 Hz for 5 min, followed by 50 Hz for 5 min and finishing with 30 Hz for 5 min; velocity from 12-40 ms-2 and amplitude varied 1.7-2.5 mm</td>
<td>Dog were placed at the center of the vibrating platform standing on all four feet; ultrasound exams were performed before and immediately after the WBVE platform session.</td>
</tr>
<tr>
<td>Santos et al.</td>
<td>10 healthy intact Beagle dogs, 3 females and 7 males, age range from 2-4 years old and body mass range from 10.1-17.9 kg</td>
<td>5 days (15 minutes/day)</td>
<td>30 Hz for 5 min, followed by 50 Hz for 5 min and finishing with 30 Hz for 5 min; velocity from 12-40 ms-2 and amplitude varied 1.7-2.5 mm</td>
<td>Dog were placed at the center of the vibrating platform standing on all four feet; blood samples were collected before, immediately after, 1 h and 6 h after the end of each session, and 24 h and 48 h after the last WBVE session.</td>
</tr>
</tbody>
</table>
in 10 healthy dogs after a single WBVE session (table 1). Ultrasound exams were performed to identify and evaluate each kidney and the renal vascular tree before and immediately after the vibration session. No significant differences were observed between the resistivity index values obtained before and immediately after the session, suggesting that WBVE single session does not alter the renal resistivity index.

A recent study that subjected 10 healthy Beagle dogs to a WBVE protocol of 15 minutes session per day during 5 consecutive days (table 1) was conducted by Santos and others. Blood samples were collected from each dog once before and 3 times after each session, and also 24 and 48 hours after the last WBVE session. Hemogram and serum biochemistry were analyzed for each blood sample and results showed all haematological and serum biochemical values within the reference range. Results from this study suggest that daily sessions of 30 Hz followed by 50 Hz and finishing with 30 Hz for 5 minutes each during 5 consecutive days of WBVE do not cause adverse effects on haematology and serum biochemistry.

**Whole-body vibration exercise as therapeutic modality for animals**

Whole-body vibration was described as an adjuvant in the postoperative physiotherapy protocol in a calf. A six-week-old female calf was diagnosed with deformation of the right forelimb associated with supernumerary digits (Table 2). The calf was submitted to surgical removal of both supplementary distal digits and rehabilitation starting 21 days after surgery with WBVE using a vibrating platform daily at 15 to 21 Hz, for 10 minutes.

Prior to surgery the right forelimb showed a hyperflexion of the fetlock and carpal joints and weight bearing on the dorsal aspect of the fetlock joint. The removal of both additional digits allowed full weight-bearing and full extension of the affected limb, and the carpus valgus formation, which was improved during the rehabilitation phase.

Long-term and immediate effects of WBVE were assessed in eight horses with chronic lameness (table 2). Horses were submitted to a WBVE session of 30 minutes twice a day, five days per week, during 60 days. Lameness was evaluated subjectively by a veterinarian and objectively by using a lameness locator (computer system). Long-term evaluations were made at days 0, 30 and 60 of WBVE sessions and immediate evaluations at day 30, 35, 55 and 60 immediate before and within 30 min after the WBVE sessions. Horses with primary forelimb lameness show a significant improvement in long-term evaluations after the first 30 days and a significant worsening after the second 30 days. The immediate effect of WBVE showed a significant worsening in forelimbs lameness and no statistically significant difference in lameness in hindlimbs.

A study performed by Santos and colleagues with 12 penguins evaluated the effects of WBVE training in healthy penguins and penguins with bumblefoot (table 2). Penguins were submitted to a single 15 minutes session of WBVE, which was divided in three moments of five minutes. The temperature of penguins’ feet was measured with an infrared thermography camera before and after each moment of the session. An increase in temperature in the plantar surface of the feet was observed, and penguins with bumblefoot did not presented a significant increase in temperature.

Effects of WBVE sessions were shown on the multifidus muscle in nine horses with clinical signs of back pain associated with lameness. WBVE protocol was 30 minutes, twice a day, five days a week for 60 days. Lameness was subjectively evaluated by a veterinarian and ultrasound images were used to measure the cross-section area of the multifidus muscle, captured at days 0, 30 and 60 of treatment. A significant increase of the total (left and right) cross-section area and an improvement in symmetry of the multifidus muscle were observed after WBVE sessions.

WBVE as described as an adjuvant therapy in a case of metritis in a dog (Table 2). A two-years-old female American Pitt Bull terrier was diagnosed with metritis. Physical and complementary examination detected a slight vulvar edema, an enlarged uterus with hypoechoic luminal content on ultrasound exam, and no significant alterations at blood exams. A single session of WBVE exercise was performed, and after 6 minutes a purulent vulvar discharge was observed and remained throughout the session. Ultrasound and blood exams after 7 days showed no sign of abnormalities.

**Discussion**

Use of WBVE as a therapeutic modality has been studied for the past 20 years in human patients. Therefore why not apply this modality also to animals? A few studies have shown that WBVE between 10 to 15 minutes/session and frequencies from 15 to 50 Hz have no deleterious effects in renal resistive index in dogs
and haematological and biochemistry parameters in dogs and horses. More studies are necessary to assure safety parameters for the use of WBVE in animals; nevertheless these results are important to guide future studies. Therapeutic effects of WBVE in animals have been shown in a few papers. Some positive effects have been reported, such as improvement in the conditions of lame horses and of a calf treated up to 30 days with WBVE. Additionally, a significant outcome in muscle symmetry and hypertrophy was observed in horses with back pain. Positive outcomes of WBVE as a therapeutic adjuvant or modality in animals have been promising, warranting further study. On the other hand, WBVE may provide no benefits or negative effects, as observed in two studies on immediate effects of WBVE sessions which presented no significance difference in hindlimb of lame horses and in temperature of the feet of penguins with bumblefoot. Therefore, caution is essential, for the wrong WBVE protocol may cause adverse effects.

**Final considerations**

WBVE provides benefits to animals as well as to human patients. However, the use of wrong vibration parameters also causes adverse effects in animals. Therefore, more studies are required to determine the effectiveness and safety of WBVE protocols in each species and to explore other therapeutic applications.

**References**

1. Wasserman DE, Badger DW. Vibration and its Relation to Oc-

Table 2. Overview of Whole-Body Vibration studies as a therapeutic modality in domestic animals.

<table>
<thead>
<tr>
<th>Study</th>
<th>Subjects</th>
<th>Duration</th>
<th>Parameters</th>
<th>Study design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carstanjen et al.</td>
<td>A 6-week-old female German Holstein-Friesian calf, weighting 67 kg, with deformation of the right forelimb associated with two supernumerary digits</td>
<td>15 to 21Hz, for 10 minutes</td>
<td>Calf had the supernumerary digits surgically removed; rehabilitation started 21 days after surgery, including passive manipulation of the limb, the application of dorsal claw extensions, walking exercise and WBVE sessions.- training</td>
<td></td>
</tr>
<tr>
<td>Halsberghe</td>
<td>8 adult horses, age range from 6.7-15.4 years; horses breeds were Warmblood geldings (n=4), Irish sport horse geldings (n=2), Thoroughbred gelding (n=1), and Thoroughbred mare (n=1)</td>
<td>60 days (30 minutes/2x per day) 5 days per week</td>
<td>40 Hz for 30 minutes; amplitude of 0.8 millimeter, and an acceleration of 4.9 m/ s² (0.5 g)</td>
<td>A hay net was provide to keep horses occupied; lameness was evaluated subjectively by a veterinarian using a lameness scale and objectively lameness by using a real-time handheld computer system using body-mounted inertial sensors (lameness locator)</td>
</tr>
<tr>
<td>Santos et al.</td>
<td>12 captive adult magellanic penguins (Spheniscus magellanicus), weighting from 2.52-3.88 kg</td>
<td>Single session (15 minutes)</td>
<td>20 Hz for 3 moments of 5 minutes; velocity and amplitude varied from 12-40 m secG2 and 1.7-2.5 mm, respectively</td>
<td>Pinguins were kept inside a plastic box placed over the platform; infrared thermography was performed before and after each moment of WBVE training (0, 5, 10 and 15 minutes of session)</td>
</tr>
<tr>
<td>Halsberghe et al.</td>
<td>9 adult horses, age range from 6.0-14.4 years; horses breeds were Warmblood geldings (n=5), Irish sport horse geldings (n=2), Thoroughbred (one gelding and one mare)</td>
<td>60 days (30 minutes/2x per day) 5 days per week</td>
<td>40 Hz for 30 minutes; amplitude of 0.8 millimeter, and an acceleration of 4.9 m/ s² (0.5 g)</td>
<td>Lameness was evaluated subjectively by a veterinarian using a lameness scale and ultrasound images of the m. multifidus were captured and used to measure the cross-section area.</td>
</tr>
<tr>
<td>Santos et al.</td>
<td>A 2-year-old, intact female American Pit Bull Terrier dog, weighting 32 kg, with slight vulvar edema</td>
<td>Single session (15 minutes)</td>
<td>30 Hz for 5 min, followed by 50 Hz for 5 min and finishing with 30 Hz for 5 min; velocity from 12-40 ms-2 and amplitude varied 1.7-2.5 mm</td>
<td>A purulent vulvar discharge was observed 6 min following the exposure to WBVE and remained continuous throughout the session; antibiotic therapy was prescribed for 15 days.</td>
</tr>
</tbody>
</table>