Journal of Equine Veterinary Science 34 (2014) 1197–1200

Contents lists available at ScienceDirect

Journal of Equine Veterinary Science

journal homepage: www.j-evs.com

Original Research

Efficacy of an Extract of Blue-Green Algae in Amelioration of Lameness Caused by Degenerative Joint Disease in the Horse

Jennifer S. Taintor DVM, DACVIM [a,*], James Wright DVM, PhD, DACVPM [b], Fred Caldwell DVM, DACVS [a], Bailey Dymond MS [c], John Schumacher DVM, DACVIM [a]

[a] Department of Clinical Sciences, Auburn University College of Veterinary Medicine, JT Vaughan Teaching Hospital, Auburn University, Auburn, AL
[b] Department of Anatomy, Physiology and Pharmacology, Auburn University College of Veterinary Medicine, Auburn University, Auburn, AL
[c] Auburn University Athletics, Auburn, AL

ARTICLE INFO

Article history:
Received 14 April 2014
Received in revised form 18 June 2014
Accepted 9 July 2014
Available online 16 July 2014

Keywords:
Horse
Osteoarthritis
Anti-inflammatory
C-phycocyanin
Supplement

ABSTRACT

Degenerative joint disease (DJD) or osteoarthritis in the equine is largely a result of biomechanical stressors that result in inflammation within the joint, which with continual exposure, leads to progressive degeneration. A myriad of therapies are available for treatment of horses with DJD including nonsteroidal anti-inflammatory drugs, corticosteroids, physiological modifiers, and biological therapies. C-phycocyanin, a protein-bound pigment found in blue-green algae, has been shown to have anti-inflammatory and antioxidant properties and is available as a diet supplement in people, dogs, and horses. Forty-one horses with naturally occurring lameness as a result of DJD were selected for this study. In a blinded study, horses were randomly assigned to either the commercial or placebo product that was fed once daily for 12 months. At selected time points, lameness evaluation was performed through objective gait analysis. Previous medical records for management of lameness were reviewed for all enrolled horses. No statistically significant differences existed within or between the two groups when gait was evaluated objectively nor within individual horses between time points. Review of medical records found that five treated horses had a decreased in frequency of intra-articular injection of corticosteroids. Although this study did not find statistically significant improvement of lameness with oral daily supplementation of C-phycocyanin in equine athletes, there appeared to be a trend of improvement in lameness during the loading period and a decrease in frequency of administration of intra-articular corticosteroids. Further investigations using a higher dose seem warranted.

1. Introduction

Degenerative joint disease (DJD) or osteoarthritis in the equine athlete is a major cause of economic loss to the equine industry through loss of revenue from an inability to perform and expense of treatment. Biomechanical stress either as a major event or multiple low-grade events is a common etiology of DJD and results in a synovial inflammation, degradation of cartilage, and changes of the subchondral bone. Development and propagation of changes within the joint as a result of DJD is a consequence of the combination of a release of proinflammatory cytokines (interleukin-1 and tumor necrosis factor alpha [TNF-α]), extracellular matrix degrading enzymes, arachidonic acid metabolites, and oxygen free radicals [1–3]. These substances in turn cause synovial inflammation, cartilage

* Corresponding author at: Jennifer S. Taintor, DVM, DACVIM, Department of Clinical Sciences, Auburn University College of Veterinary Medicine, JT Vaughan Teaching Hospital, Auburn University, 1500 Wire Rd, Auburn, AL 36849.
E-mail address: taintjs@auburn.edu (J.S. Taintor).

0737-0806/$ – see front matter © 2014 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.jevs.2014.07.007

degradation, and subchondral bone remodeling creating a vicious cycle. Joint pain, which is commonly manifested as lameness, is a result of exposure of sensory nerves of the synovial capsule, synovium, and subchondral bone to a combination of mechanical stimuli, such as joint effusion, and chemical mediators, such as those involved in inflammation.

A myriad of drugs and modalities are available for the treatment of horses with DJD in an effort to decrease, block, or ameliorate the chemical mediators that are involved with or produced by the inflammatory cascade and the changes associated with DJD. The most regularly used medications are aimed at the blocking arachidonic acid cascade, which leads to the production of prostaglandins, and include intra-articularly administered corticosteroids, systemic administration of nonsteroidal anti-inflammatory drugs, and various novel medications, such as extracts from various plants, marine organisms (green-lipped mussels), and algae [4]. C-phycocyanin, a protein-bound pigment found in blue-green algae, appears to have anti-inflammatory and anti-oxidant properties [5]. Several studies investigated this pigment's ability to inhibit proinflammatory cytokines, most notably TNF-α, oxygen free radicals, and cyclooxygenase-2 (COX-2) [5,6]. C-phycocyanin anti-inflammatory effects through inhibition of TNF-α, oxygen free radicals, and COX-2 selectively inhibits COX-2; many adverse effects that are often experienced with the use of nonsteroidal anti-inflammatory drugs that inhibit COX-1 and COX-2 (e.g., phenylbutazone, flunixin, and ketoprofen) are avoided. Along with its anti-inflammatory properties, C-phycocyanin is an effective oxygen radical scavenger comparable in efficacy with dimeythl sulphoxide [5,6]. C-phycocyanin has been used as a dietary supplement in people for several years in some countries with anecdotal reports of success in relieving osteoarthritic pain. Sixty-nine dogs and 40 horses that were lame as a result of osteoarthritic pain were administered C-phytocyanin daily for 4 months, and, based on subjective evaluation, improvement in gait of these animals was observed by 90% of owners [7].

2. Materials and Methods

2.1. Horses

Forty-one horses with naturally occurring lameness as a result of DJD based on localization of the lameness through regional anesthesia and radiographic examination currently used by the Auburn University Equestrian team were selected for this study after approval by Auburn University's Institutional Animal Care and Use Committee. These horses were exercised a minimum of 30 minutes during practice sessions conducted 3 days a week and competed in seven sporting events during the study period. Disciplines included western horsemanship, reining, equitation on flat, and equitation over fences. Horses had a median age of 10 years (range, 3–20 years) and included American Quarter Horse (21), American Paint Horse (2), Appaloosa (1), Thoroughbred (4), and Foreign Warmblood (13). At the start of the study, nine horses had a primary forelimb lameness (six coffin joint and three fore fetlock), 22 horses had a primary hind limb lameness (one hind fetlock, 18 distal tarsal joints, and three stifle), and 10 had a multiple limb lameness (two coffin and distal tarsal joints, two fore fetlock and distal tarsal joints, and six distal tarsal joint and stifle). Lameness was identified and quantified using an automated lameness detection device (Lameness Locator).

2.2. Lameness Evaluation

A body mounted, inertial sensor system (Lameness Locator) was used for objective gait analysis of each horse at a trot on a flat grass surface. This system consists of three inertial sensors affixed to the poll through a head bumper attached to the halter, on midline between the right and left tuber sacrale via velcro adhered to the skin and duct tape, and to the right fore pastern through use of a wrap [8]. The head and pelvic sensors are accelerometers, whereas the right forelimb sensor is a gyroscope. These sensors detect and quantify lameness based on torso motion resulting in calculation of the means and standard deviations of maximum and minimum differences in height of the head (for forelimb evaluation) and pelvis (for hind limb evaluation) [8–10]. Detection of lameness to the right or left thoracic limb within the stride is determined by the association of head and pelvic movement with phases of the stride through the right forelimb gyroscope sensor. Amplitude of the vector sum of maximum difference in head height (MAXDIFFHEAD) and minimum difference in head height (MINDIFFHEAD) correlates with severity of forelimb lameness, with a value of approximately 6 mm as a threshold between lame and sound [10]. The sum of maximum difference in pelvis height (MAXDIFFPELVIS) and minimum difference in pelvis height (MINDIFFPELVIS) correlates with severity of hind limb lameness, with a value of approximately 3 mm as a threshold between lame and sound [10]. Recent studies indicate that this inertial sensor system provides appropriate accuracy (sensitivity and specificity) and repeatability in evaluation of gait when the horses trot [10,11].

2.3. Procedure

In a blinded study, horses were randomly assigned to either a commercially available Phycox treatment group (PTG) (20) or a placebo-treated control group (CG) (21). These two groups were further divided by size (horses that weighed between 450 and 599 kg and horses that weighed more than 600 kg). Horses in each group were treated once daily. Horses in the PTG were treated with the commercial product, whereas horses in the CG were treated with a placebo of equal weight, volume, and texture. One scoop of the commercial product contained 240 g of C-phycocyanin. Horses in 450–599 kg group (15 treated and 11 placebo) were fed two scoops and horses in the more than 600 kg group (five treated and eight placebo) were fed three scoops; after 6 weeks of treatment, the dose for both groups was reduced to one scoop daily for the 450–599 kg group and 1.5 scoops for the more than 600 kg group for the remainder of the study. The granules were mixed with one cup of a commercial grain and molasses mixture and further mixed with 1 oz of water and then fed to each horse from a small bucket until consumed.