

Supplementing for Joint Health

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A common cause of joint disease in horses is persistent inflammation. Under such conditions, uncontrolled free radical activity and dysregulation of local enzymes result in the degradation of critical components of cartilage, synovial fluid and the synovial membrane. The joint pain that arises as a result of these processes results in lameness and “loss of use” for the horse. To combat these problems, comprehensive joint care formulas are now available that include omega-3 fatty acids, glucosamine, methylsulfonylmethane, hyaluronic acid, avocado/soy unsaponifiables, cetyl-myristoleate, antioxidants and minerals.

5 Major Contributors to Joint Disease

1. Chronic Inflammation

Omega-3 fatty acids, glucosamine, avocado/soy unsaponifiables, cetyl-myristoleate, antioxidants such as vitamin C and vitamin E, and botanical compounds, such as boswellia and curcumin, decrease inflammatory responses.

2. Free Radical Damage

Antioxidants and supplemental hyaluronic acid help protect the joint against degenerative effects of free radicals and help maintain synovial fluid viscosity and normal joint function.

3. Degradative Enzyme Activity

Omega-3 fatty acids decrease the activity of aggrecanase and other destructive enzymes in the joint and, therefore, reduce cartilage degradation. Glucosamine and avocado/soy unsaponifiables also modulate degradative enzymes and counteract them by stimulating formation of cartilage components.

4. Traumatic Injury or Overuse

Omega-3 fatty acids, antioxidants, silicon, MSM and avocado/soy unsaponifiables help slow degeneration and stimulate repair of cartilage. Silicon also supports bone density, cartilage synthesis, and tendon and ligament strength.

5. Natural Aging Process

Omega-3 fatty acids, antioxidants, and cartilage-building nutrients protect against degeneration, which naturally occurs with age.

Fatty Acids

Omega-3 fatty acids and their metabolites generally support low- or anti-inflammatory reactions, which is in contrast to the pro-inflammatory response from the metabolites of omega-6 fatty acids. For example, cell culture studies isolating various joint components treated with α -linolenic acid, an essential omega-3 fatty acid, show a reduction in the amount of stressor-induced pro-inflammatory mediators including interleukin-1 (IL-1), tumor necrosis factor-alpha (TNF- α), and prostaglandin E₂ (PGE₂).¹⁻³ The longer-chain omega-3 fatty acids, docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), show similar effects.^{4,5} *In vivo* animal research also suggests these long chain omega-3 fatty acids have a supportive role in joint health.^{4,6-9} Furthermore, the analgesic effects of omega-3 fatty acids suggest that they may be a safe alternative to non-steroidal anti-inflammatory drugs.^{10,11} On the other hand, dietary intake of omega-6 fatty acids is associated with increased osteoarthritis severity and bone marrow lesion risk,^{12,13} and the omega-6 content of joint tissue is correlated with cartilage lesion severity.¹⁴

Cetyl-myristoleate, an ester of an omega-5 fatty acid, has been effective in reducing arthritic pain and improving mobility. Studies indicate that cetyl-myristoleate blocks inflammation and protects rats and mice against experimentally-induced arthritis.^{15,16} More recently, dietary supplementation of humans with

cetyl-myristoleate has been shown to significantly improve knee range of motion and functionality.¹⁷

Glucosamine

Glucosamine, an amino sugar, is a precursor to the compression-resistant components of cartilage called glycosaminoglycans (e.g., chondroitin sulfate, hyaluronic acid). In addition to being a building block for this extracellular matrix component, glucosamine decreases the activity of collagen-degrading enzymes and increases cartilage protein synthesis.¹⁸⁻²¹ Short and long-term supplementation studies in humans suggest glucosamine prevents or slows the progression of osteoarthritis²²⁻²⁴ and may be as efficacious as ibuprofen in relieving arthritic pain.²⁵ The results of similar studies in animals indicate that glucosamine supplementation reduces the ill effects of osteoarthritis on cartilage and subchondral bone.^{26,27} Treatment of equine cartilage explants with glucosamine reduces the destructive effects of IL-1beta.²⁸⁻³¹ Glucosamine may also offer equine cartilage protection against corticosteroid-induced joint degradation.³²

Glucosamine sulfate is a highly bioavailable source of glucosamine^{33,34} and likely the preferred supplement form when compared to glucosamine hydrochloride (HCl). For example, Phitok *et al* showed that glucosamine sulfate was more effective than glucosamine HCl in reducing the catabolic effects of IL-1beta in rabbit cartilage explants and human chondrocyte cultures.³⁵ Synovial fluid glucosamine levels increase more in horses following oral glucosamine sulfate than glucosamine HCl.³⁶ These authors also reported a slightly higher bioavailability of glucosamine sulfate (9.4%) in the horse compared to glucosamine HCl (6.1%).

One concern that often is expressed regarding horses with osteoarthritis is the potential for glucosamine supplementation to adversely affect blood glucose concentrations. A published review of human research concluded that glucosamine supplements do not adversely affect fasting glucose or insulin sensitivity in healthy or diabetic

subjects.³⁷ Furthermore, researchers from Platinum Performance, Inc compared the blood glucose concentrations in horses supplemented with a joint product* that provides a daily dose of 8,500mg of glucosamine sulfate. After 4 weeks of supplementation, there was no significant increase in fasting or post-prandial blood glucose concentrations in supplemented horses when compared to non-supplemented controls. Therefore, glucosamine and supplements containing up to 8,500mg of glucosamine sulfate can safely be incorporated into equine joint care programs without fear of causing glucose dysregulation or increasing the risk for metabolic syndrome.

Methylsulfonylmethane

Due to its analgesic and anti-inflammatory effects, methylsulfonylmethane ((MSM), a sulfur-containing metabolite of dimethyl sulfoxide) is often advocated for joint pain. Because the sulfur content of arthritic cartilage can be approximately one-third that of healthy cartilage,³⁸ MSM may be therapeutic as a bioavailable source of sulfur. Furthermore, rodent models suggest co-culture with MSM can prevent cartilage degradation.³⁹ In human studies, dietary supplementation with MSM has successfully reduced joint pain and improved ability to perform regular daily functions, as well as support recovery from exercise, when consumed either alone or in combination with glucosamine.⁴⁰⁻⁴⁴ Antioxidant properties of MSM have also been documented, including those related to exercise-induced oxidative stress in humans.^{40,41,45,46} In fact, MSM has been protective against exercise-induced inflammation and oxidative stress in the horse, as well.⁴⁷ Specifically, Marañón *et al* reported that MSM supplementation could reduce lipid peroxide production and prevent reductions in glutathione and antioxidant enzyme activity that otherwise occurred in non-supplemented horses involved in jumping competition. Since oxidative stress, even that noted in the peripheral circulation and not specifically at the joint, has been implicated in the pathogenesis of joint disorders,⁴⁸ research showing MSM's

*Ortho-Chon®

antioxidant benefits may further explain MSM's utility as a joint support supplement.

Hyaluronic Acid

Hyaluronic acid is a key component of the synovial fluid that nourishes, lubricates, and protects the joint. Hyaluronic acid is also one of the building blocks for proteoglycans (such as aggrecan). It stimulates the formation of cartilage components from equine stem cells⁴⁹ and has anti-inflammatory actions in the synovial fluid by inhibiting PGE₂.⁵⁰ Reduced hyaluronic acid concentration in damaged equine joints has been associated with impaired lubrication function.⁵¹ Although commonly administered intra-articularly, orally administered hyaluronic acid has been shown to be bioavailable⁵² and effective in reducing post-operative joint inflammation in horses.⁵³

Avocado/Soy Unsaponifiables

Avocado/Soy unsaponifiables (ASU) are natural oil extracts from avocado and soy beans. Cell culture studies with ASU demonstrate its ability to increase aggrecan synthesis, prevent IL-1-induced decreases in aggrecan production, and reduce the expression or production of degradative enzymes and inflammatory proteins.⁵⁴⁻⁵⁶ ASU supplementation in humans with osteoarthritis may prevent joint space loss.^{57,58} Horses supplemented with ASU show increased synthesis of glycosaminoglycans and reduced breakdown of cartilage,⁵⁹ and ASU supplemented dogs have been shown to have higher levels of growth factors involved in cartilage synthesis when compared to non-supplemented controls.⁶⁰

Micronutrients

Oxidative stress and damage caused by reactive oxygen species have been implicated in the development of joint disorders in horses.^{61,62} Radical oxygen species promote the degradation of joint components which may be counteracted by antioxidants such as vitamins C and E. Not only is vitamin C crucial for the development of cartilage, but its well-documented antioxidant effects may also protect against cartilage breakdown.⁶³ The fat-soluble antioxidant, vitamin E, has analgesic and mobility-

enhancing benefits in individuals with arthritis⁶⁴ and, when used in combination with other antioxidants, has been shown to protect mice prone to developing osteoarthritis against joint disorders.⁶⁵ Silicon is a micronutrient that is required for normal formation of cartilage and bones. Growing chicks that consume diets that are deficient in silicon show abnormal articular cartilage, abnormal bone development and abnormal growth of the comb,⁶⁶ a structure that is abundant in connective tissue and hyaluronic acid.

Conclusion

Joint disorders in horses are serious and debilitating conditions. The diverse causes of joint degeneration require a comprehensive supplementation program that addresses each contributing factor. Provision of omega-3 fatty acids, glucosamine, methylsulfonylmethane, hyaluronic acid, avocado/soy unsaponifiables, cetyl-myristoleate, antioxidants, and silicon modulates the major factors associated with joint disorders.

Putting it into Practice

- Reduce feeds with an imbalance of omega-3 and omega-6 fatty acids such as grains, corn oil and some commercial feeds.
- Encourage consumption of omega-3 fatty acids and antioxidants by increasing the horse's intake of forage and pasture grazing.
- Supplement with omega-3 fatty acids, vitamins, antioxidants, and trace minerals on a daily basis to protect the joint against inflammation and oxidative stress.
- For horses with existing joint problems or those prone to developing joint problems, supplement with additional nutrients such as glucosamine, hyaluronic acid, MSM, cetyl-myristoleate, and ASU.

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