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Bone Health in Dogs: An In-Depth Analysis of Osteoarthritis and Natural Remedies

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Abstract

Dogs with osteoarthritis (OA) experience pain, limited movement and a lower standard of living. This study offers a thorough examination of the risk factors, diagnostic techniques and underlying reasons for canine OA. In addition to four normal-looking dogs, the study involved 40 cases of dogs with multiple joint OA who were free from other concomitant mental, metabolic, or viral disorders. Of them, 44 dogs were split into two sets: Unhealthy (G1) and Healthy (G2), which included 22 dogs. While G1 is given daily oral collagen peptide (1.0-2.0 mg/kg bwt) and vitamin D (0.02-0.03 mg/kg bwt) + calcium (25 mg/kg bwt) + sunthi (0.08 gm/kg bwt) for one month, G2 acts as the wellness condition. One of the characteristics that were examined was the frequency of bone-related illnesses in dogs. On the 30th day, G1 showed a significant decrease in lameness, which was explained by the synergistic action of collagen peptide, calcium, vitamin D and Sunthi, which relieved OA pain. There was a significant fall in C-reactive protein (CRP) and uric acid. To diagnose OA, radiography and clinical signs were utilized. G1 is therefore superior to G2 in this regard.

Keywords- Dog, osteoarthritis (OA), vitamin D, bone health, CRP, uric acid, clinical signs

INTRODUCTION

The powerful bone structure is essential for an energetic and active existence for a human's greatest friend, the devoted and affectionate pet. Dogs can have bone-related problems, such as osteoarthritis, which is a common worry for our beloved pets. Pet owners must be aware of the complexities of canine bone health to provide their animals with the care and preventative steps necessary to guarantee a comfortable and active life (1).

The Fundamentals of Dog Bone Health

A dog's skeleton is a complicated structure made of bones, joints and connective tissues. A dog's general health and movement depend on keeping ideal bone health. In their latter years, dogs get osteoarthritis, a degenerative joint condition. This disorder causes discomfort, inflammatory processes and decreased joint flexibility due to the degeneration of cartilage in the joints. When developing successful preventative measures, it is essential to comprehend the causes that lead to osteoarthritis (2, 3).

The Substances Affecting Bone Health

A dog's bone health can be affected by several variables, including its breed, weight, age and heredity. Because they are larger and heavier than other breeds, larger breeds are more likely to have joint problems. In addition, some dogs can be more susceptible to bone issues due to certain genetic predispositions. Due to the gradual accumulation of joint wear and strain, aging has an impact. It is essential that pet owners understand these elements and adjust their schedules for care appropriately (4, 5).

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Evaluating Dog Osteoarthritis

Early diagnosis of osteoarthritis symptoms is critical for prompt treatment. Dogs with this illness can show symptoms including lameness, stiffness, resistance to activity and behavioral abnormalities. Pet owners could swiftly seek expert veterinarian help by being aware of these indications (6, 7).

Herbal Treatments for Dog Osteoarthritis

Many dog owners are looking for natural solutions to ease symptoms and improve overall bone health. Some important things that can help are taking products like Omega-3 fatty acids, glucosamine and chondroitin, which are known to reduce inflammation and strengthen joints. A balanced diet and frequent exercise are necessary to help the dog maintain an ideal body weight, which lessens the strain on their joints. It is advised to engage in low-impact exercises like walking and swimming to increase muscular strength and joint flexibility without putting too much pressure on the body. The use of herbal treatments, such as boswellia and turmeric, is growing in popularity due to its ability to reduce inflammation and ease pain in dogs suffering from osteoarthritis (8, 9).

In the research (10) dogs were used as osteoarthritis (OA) models and the influence of the FGF4 retrogene insertion was studied. When the cartilage of dogs with non-chondrodystrophic (NCD) and chondrodystrophic (CD) conditions was compared, it was shown that dogs with NCDs had a higher risk of developing OA. It revealed the significance of the FGF4 retrogene in the pathobiology of OA.

This article (11) evaluated that acellular nano-materials were implanted after fracture surgery in experimental regrowth of cartilage models. Acellular biomaterial implantation increased cartilage regeneration by 15.6% compared to non-treated defects, while biologics contributed 7.6%. No significant changes were seen across biomaterials or animal models.

In research (12) an early mechanical change approach for articular cartilage (AC) and subchondral bone (SB) in Dunkin Hartley guinea pigs was developed for OA problem. Mechanical parameters were associated using nanoindentation on proximal tibia tissues at varied ages. Early OA increased deep AC stiffness, but severe OA decreased intermediate AC stiffness. Subchondral bone stiffness decreased initially but increased in severe OA.

This study (13) looked at how well intra-osseous (IO) PRGF injections worked for rabbits with acute full-depth chondral lesions. After IO PRGF injections, 40 rabbits with induced chondral abnormalities were separated into control and treatment groups. Histological examination occurred 56 and 84 days post-surgery. The therapy group had improved histology scores, showing IO PRGF can treat chondral lesions long-term.

The Author (14) created an injectable and biodegradable piezoelectric hydrogel for treating OA. They manufactured and tested the hydrogel's injectability, biodegradability and piezoelectricity. In vitro and in vivo investigations evaluated its OA therapeutic effectiveness. According to Nature Communications, the hydrogel has good injectability, biodegradability and osteoarthritis therapy potential.

The research (15) investigated using artificial intelligence (AI) in tissue engineering to accelerate bone repair. They look at the possibilities of artificial intelligence in bone regeneration by incorporating it into tissue engineering procedures. The result showed a revolutionary future for bone regeneration using the incorporation of AI into tissue engineering techniques.

The study (16) focused on iron metabolism, malondialdehyde and 4-hydroxynonenal-induced peroxidation of lipids in osteoarthritis. In particular, they examined methods associated with ferroptosis, malondialdehyde and 4-hydroxynonenal. It highlights the significance of ferroptosis, malondialdehyde as well as 4-hydroxynonenal in the pathogenesis of osteoarthritis and defines the function of peroxidation of lipids.

The research (17) tested the effectiveness of repairing full-depth cartilage abnormalities using plasma rich in growth factors (PRGF). Intraosseous PRGF infiltration was done on rabbits with full-depth cartilage lesions. The research examined PRGF's cartilage defect repair and regeneration capability. In rabbits with full-depth

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cartilage abnormalities, intraosseous PRGF infiltration showed encouraging outcomes in promoting cartilage regeneration and repair, indicating its potential as a therapeutic strategy.

The study (18) examined the effects of anti-inflammatory medications as well as initial mechanical unloading on the development of post-traumatic osteoarthritis (PTOA) in rats. Mechanical unloading and anti-inflammatory medication were given to injured mice. The researchers examined joint tissues for PTOA progression. Hind Limb Unloading (HLU) decreased protease activity and synovitis on day 7 post-injury. Trabecular bone preservation during unloading was lost during reloading. HLU and Celecoxib (CXB) reduced osteophyte volume.

The author (19) used nanoindentation to identify premature deteriorative alterations in an instance of Impromptu OA. It examined OA cartilage mechanical characteristics. The indentation method showed early tissue degeneration. In the deep zone, articular cartilage (AC) stiffness was higher in early-stage OA, but subchondral bone (SB) stiffness was higher in severe OA.

METHODOLOGY

From March 2023 to August 2023, dogs from the Teaching Veterinary Clinical Complex (TVCC) had a total of 459 suspected cases evaluated for the presence of bone-related illnesses. Dogs owned by clients provided samples and these dogs had symptoms indicative of OA, such as lameness, an inability to run or climb stairs with a jumpy gait, a preference for sitting or lying down over standing, trouble getting up from a resting position and stiffness thereafter. For the purpose of confirming the diagnosis of OA, they underwent thorough physical, orthopaedic and radiographic exams. Out of them, 135 animals tested positive for osteoarthritis and 44 dogs (22 sick and 22 healthy) were chosen for the research. The following research was done to treat them.

The procurement of blood and serum samples

This study explores the effects of osteoarthritis on certain hematological and biochemical profiles by taking an in-depth examination of the health of dogs' bones. Six milliliters of blood, extracted from the radial vein or recurrent tarsal vein, were analyzed from clients suspected of having osteoarthritis based on clinical indications and symptoms as well as a medical history of the condition. To evaluate crucial circumstances, samples from dogs in good condition were compared. 3 ml of whole blood was drawn for haematological parameters and 1 mg of ethylene-diamine tetra acetate (EDTA) per milliliter of blood was placed in a sterile plastic bottle. Serum extraction from the drawn blood samples was done concurrently.

Hematological parameters studies

The concentration of hemoglobin (Hb) in the blood was measured using the Cyanmethaemoglobin technique, with results given in gm/dl. The findings were given as a percentage (%) of the whole volume. The Hemocytometer technique was used to determine the Total Erythrocyte Count (TEC), which was represented as millions per microliter. A hemocytometer was used to measure the total leukocyte count (TLC) and the findings were represented as thousands per microliter.

Radiographic Examination in Dog Bone Health

A comprehensive investigation into osteoarthritis and natural remedies before and after therapy, ventro-dorsal images of the afflicted joints was captured for radiographic assessments. Furthermore, a long ventral-dorsal view was used to examine the hip joints.

Therapeutic intervention

For this study, forty-four dogs were randomly chosen and the 44 dogs were split into two sets: Unhealthy (G1) and Healthy (G2), which included 22 dogs. While G1 is given daily oral collagen peptide (1.0-2.0 mg/kg bwt) and vitamin D (0.02-0.03 mg/kg bwt) + calcium (25 mg/kg bwt) + sunthi (0.08 gm/kg bwt), G2 acts as the wellness condition in which treatment was not given.

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RESULTS AND DISCUSSION

The purpose of this study's goal was to investigate the clinical, hematological, blood serum biochemical and radiographic aspects of osteoarthritis (OA) in dogs on various treatment days. This research addressed the importance of therapeutics, which can help to minimize OA alterations in dogs. The assessment of hematobiochemical profiles, radiographic examination and clinical sign monitoring were used to evaluate the effectiveness of various medications in treating osteoarthritis.459 suspected cases of dogs from the Teaching Veterinary Clinical Complex (TVCC) were examined for the possibility of bone-related disorders between March 2023 and August 2023. Out of them, 135 animals tested positive for osteoarthritis and 44 dogs (22 sick and 22 healthy) were chosen for the research. The following study was conducted to treat them. They received extensive physical, orthopaedic and radiological testing to verify their suspicions of OA. Table (1) demonstrates the total number of dogs among the occurrence of bone-related disorders.

Table (1). The occurrence of bone-related diseases (Source: Author)

Disorder	No of Cases
Fracture	90
Hip Dysplasia	120
Osteoarthritis	169
Others	80
Total	459

The current study's findings showed that male dogs had a greater frequency of joint diseases than female dogs. This finding could have been caused by a sex-related factor, males' quicker growing rate, or males' more aggressive behavior. Table (2) shows the probability of osteoarthritis (OA) in dogs according to gender. The impact of testosterone on intact males' wandering behaviour can be the cause of the higher prevalence of osteoarthritis in male dogs.

Table (2). The occurrence of OA in Dogs based on Gender (Source: Author)

Gender	No of Dogs
Female	53
Male	82
Total	**135**

Variations in the incidence of osteoarthritis reported in different breeds can be ascribed to a variety of factors, including different types of joint disorders, a strong correlation between specific joint ailments and specific breeds, differences in the rate of body weight gain and influences resulting from environmental, genetic and nutritional factors. Table (3) demonstrates the Breed of dogs.

Table (3). The occurrence of OA in Dogs based on Breed (Source: Author)

Breed	No of Dogs
Labrador	48
German Shepherd	35
Golden Retriever	39
Non-describe Dogs	13
Total	**135**

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The higher frequency of hip joint disorders observed in this study could be related to the complexity of the joint's motion, making the joint more susceptible to trauma. It can be related to variations in the dogs' genetic mutations and environmental factors that have a direct impact on their growth. Table (4) demonstrates joints affected by OA in dogs.

Table (4). Joints affected by OA in dogs (Source: Author)

Joint	No of Dogs
Hip joint	28
Hock	17
Shoulder	50
Elbow	40
Total	**135**

An increased risk of joint degeneration can be attributed to the high incidence of joint disorders in dogs older than six years. It has been observed that as dogs age, their chondrocytes' ability to maintain metabolic homeostasis declines, resulting in changes to the composition and organization of collagen and proteoglycans. Table (5) shows the age-based distribution of OA in dogs.

Table (5). Distribution of OA in Dogs based on age-wise (Source: Author)

Age Wise	No of Dogs
1-2 yrs	12
3-5 yrs	30
6-10 yrs	68
Above 10 yrs	25
Total	**135**

In addition to estimating occurrence for this study, a combined count of 44 dogs was chosen. 44 dogs were split into two sets: Unhealthy (G1) and Healthy (G2), which included 22 dogs. While G1 is given daily oral collagen peptide (1.0-2.0 mg/kg bwt) and vitamin D (0.02-0.03 mg/kg bwt) + calcium (25 mg/kg bwt) + sunthi (0.08 gm/kg bwt) for one month, G2 acts as the wellness condition in which treatment was not given. Before and after therapy, ventro-dorsal images of the afflicted joints were captured for radiographic assessments. Furthermore, a long ventral-dorsal view was used to examine the hip joints.

After 15 to 30 days of therapy, the clinical symptoms of the G1 dogs in this research were reported to improve. In osteoarthritis, Ca and Phosphorus in Table (6) considerably increase in G1 compared to G2. In osteoarthritis, uric acid (g/dl) and C-RP (mg/dl) in Table (7) reduced in G1 compared to G2. However, after 15 and 30 days of therapy, the animals in the treated groups gradually improved.

Table (6). Phosphorus (mg/dl) and calcium (gm/dl) changes in healthy and unhealthy dogs (Source: Author)

Phosphorus (mg/dl)				
Group	G1		G2	
	Mean	Standard	mean	Standard
Day 0	3.20	0.02	4.0	0.05
Day 15	5.46	0.13	4.38	0.13
Day 30	6.24	0.15	4.59	0.10
Calcium (gm/dl)				
Group	G1		G2	

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	Mean	Standard	mean	Standard
Day 0	6.98	0.22	8.45	0.11
Day 15	9.56	0.48	8.95	0.18
Day 30	10.35	0.49	9.22	0.17

Table (7). Uric acid (gm/dl) and CR-P protein (gm/dl) changes in healthy and unhealthy dogs (Source: Author)

Uric Acid (gm/dl)				
Group	G1		G2	
	Mean	Standard	mean	Standard
Day 0	1.36	0.49	0.11	0.02
Day 15	1.05	0.27	0.11	0.03
Day 30	0.54	0.09	0.11	0.03
CR-P (gm/dl)				
Group	G1		G2	
	Mean	Standard	mean	Standard
Day 0	7.01	1.25	2.78	0.02
Day 15	4.78	0.78	2.78	0.02
Day 30	3.45	0.41	2.78	0.03

It is believed that osteoarthritis affects the elderly dog population. Dogs with osteoarthritis did not exhibit any notable alterations in hematological markers. The mean value of uric acid was reduced across all treatment groups due to biochemical changes. Reduced joint spaces, sclerosis development, articular cartilage degradation and increased bone opacity were associated with radiograph osteophyte formation. In combination with other conventional medications, ginger seems to have strong anti-inflammatory and analgesic properties, as shown by clinical, biochemical and radiological examinations of osteoarthritic dogs in G1. Herbal medications are cost-effective, low-risk of side effects, long-lasting and an adjunct to conventional and alternative therapy. By day 30, G1 had improved compared to G2 and by day 30, clinical symptoms, blood parameters and radiography showed some improvement. In comparison to standard therapy alone, collagen peptide treatment had a good therapeutic response when combined with calcium, vitamin D and sunthi in an oral form.

CONCLUSION

This research highlights the significant effects of osteoarthritis (OA) on dogs, highlighting the discomfort, limited mobility and reduced quality of life that affected animals go through. The thorough inquiry explores the fundamental causes of dog OA as well as its risk factors and diagnostic techniques. The study carefully ruled out any coexisting mental, metabolic, or viral conditions in 40 instances of dogs with multiple joint OA. The dogs were split into two groups: the Healthy group (G2) acts as the wellness condition and the Unhealthy group (G1) received daily oral collagen peptide, vitamin D, calcium and sunthi for a month. G1 demonstrated a significant reduction in lameness on day thirty-first, which could be due to the synergistic effects of collagen peptide, calcium, vitamin D and Sunthi, which reduced pain caused by osteoarthritis. Likewise, G1 had lower levels of uric acid and C-reactive protein (CRP). The results of the investigation demonstrated that G1 was superior to G2 in terms of diagnosing OA using radiography and clinical indications. This research provides significant insights into the management and potential treatments for the excruciating condition, which has promise for enhancing the quality of life for dogs suffering with osteoarthritis.

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