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Dietary Supplemental Safety and Efficacy of Herbal Joint Health-care Formulation in Management of Osteoarthritis and Other Orthopedic conditions in Canines

Pradeep R[1], Bhagwat V G[2] and Varun Kumar K[2]
[1](*Paws and Claws Pet Hospital, Abbigere, Bengaluru 560 090, Karnataka, India.*)
[2](*Himalaya Wellness Company, Makali, Bengaluru 562 162, Karnataka, India.*)

***For Correspondence**

Dr. Bhagwat Vishwanath G
Senior Principal Scientist
Research and Development Center, Himalaya Wellness Company
Makali, Bengaluru 562 162, Karnataka, India

dr.bhagwat@himalayawellness.com

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Abstract: Conventional care for osteoarthritis (OA) in dogs is largely symptomatic. Non-steroidal anti-inflammatory drugs (NSAIDs) are routinely used, but their adverse effects encourage exploration of adjunct or alternative options. This study evaluated the safety and effectiveness of supplementing Herbal Joint Health-care Formulation (HJHF) in managing canine OA-related disorders, hip dysplasia, and fracture-associated joint issues. Ten client-owned dogs with history of hip dysplasia (unilateral or bilateral), osteoarthritis, joint effusion, lameness, and sprain were selected in one group (G1), and received HJHF (1-2 tablet daily) as an adjunct to standard care until clinical recovery. Outcome measures included lameness, joint mobility, pain on palpation, weight bearing, and overall clinical condition scores. Clinical examinations also covered lameness, pain, reluctance for exercise and stair climbing, behavioral change, gait alteration, range of motion (ROM), joint effusion/thickening, inactivity or stiffness, and muscle atrophy. Scores across these domains improved significantly ($p<0.05$) as early as day 30 when HJHF was combined with usual treatment. Complete clinical recovery was observed by day 90 in most cases with continued adjunct HJHF. Overall, once-daily HJHF may be recommended as a supportive supplement for dogs with OA-related conditions, hip dysplasia, fracture, joint disorders.

I. INTRODUCTION

Arthritis is common and often presents with substantial joint pain. Osteoarthritis (OA), the degenerative form of joint disease, is the most frequent subtype[1] OA is a long-standing inflammatory joint disorder characterized by pain, stiffness, swelling, and lameness, driven by loss of cartilage cushioning and synovial fluid changes. It affects the entire synovial joint including cartilage, synovial fluid, and bone. The disease is marked by cartilage and soft tissue degeneration, bone hypertrophy at the joint margins, and changes in the synovial membrane.[2] Arthritis is a chronic condition observed in both humans and animals. Among domestic and companion animals, dogs are more commonly affected due to factors such as excessive physical activity, injuries, or genetic predisposition. Certain breeds, such as Labrador Retrievers and German Shepherds, are genetically more prone to developing joint inflammation.[3]

Mechanical stress is thought to initiate biochemical cascades that degrade articular cartilage.[4] During this process, the cartilage cells produce insufficient proteins needed for repair leading to the pitting and fraying of cartilage. This damage reduces the elasticity and protective function of the cartilage as proteoglycans are broken down by enzymes. As cartilage deterioration progresses, friction occurs between bones, causing inflammation, thickening of soft tissues, and restricted joint mobility. In response to this damage, the joint attempts to balance injury and repair, but over time, the joint structure deforms, and the joint space narrows. Osteophytes develop at the attachment points of ligaments and the joint capsule. Additionally, fluid-filled cysts may form, and fragments of cartilage or bone can accumulate in the joint cavity. These changes result in pain, swelling, and enlargement of the affected joint.[5]

Currently, NSAIDs are the principal pharmacological option for analgesia and anti-inflammation in OA.[6] While most patients respond well to NSAIDs, about 5–10% discontinue treatment due to adverse effects on the gastrointestinal, renal, or hepatic systems, and 10–12% may not achieve adequate relief.[7] In such cases, pet owners often seek natural alternatives that are perceived to have fewer side effects but may act similarly to NSAIDs.[8] Literature reports evidenced about the anti-inflammatory and analgesic properties of several botanical agents including *Boswellia serrata*,[9] *Cissus quadrangularis*,[10] *Zingiber officinale*,[11] and *Ananas comosus*.[12]

Considering these perspectives and the increasing interest in herbal alternatives, a “Herbal Joint Health-care Formulation (HJHF)” was developed by Himalaya Wellness Company. This formulation is claimed to support optimal bone and joint health, as well as aid in the management of conditions such as hip and elbow dysplasia, osteoarthritic joint disorders, and fractures in canines. It is also said to help nourish, maintain, and support cartilage and joint integrity. Therefore, the present in-vivo study was undertaken to evaluate the safety and efficacy of HJHF in managing osteoarthritic joint disorders, hip dysplasia, and fractures in dogs.

II. MATERIALS AND METHODS

2.1 Herbal joint health-care formulation

Mobility Plus® Advance is a proprietary herbal joint health-care formulation (HJHF) developed by Himalaya Wellness Company, Bengaluru, India composed of mainly *Boswellia serrata* (Shallaki), *Cissus quadrangularis* (Asthisamhara), *Zingiber officinale* (Shunti), *Ananas comosus* (Ananas) fortified with glucosamine, and methyl sulfonyl methane.

2.2 Ethical committee approval

The present study was conducted according to guidelines laid down for the care and use of animals, and the study protocol was approved by the Institutional Animal Ehtics committee, Himalaya Wellness Company, Bangalore (Protocol No. AHP-SA-12-21).

2.3 Study subjects

A total of 10 clients owned dogs of different breed presented to Curative Pet Clinic in Bengaluru with history of hip dysplasia (unilateral or bilateral), osteoarthritis, joint effusion, lameness, and sprain were enrolled into the study. The age of selected dogs was between 2 to 9.5 years. The study details, treatment plan, outcomes and

other pros and consequences were explained to the pet owner, and the consent was obtained before enrolled them into the study.

2.4 Study design and experimental details:

10 eligible client's owned dogs were selected in one group (G1) and supplemented with HJHF 1 tablet daily along with standard treatment till complete recovery. Based on the severity of disease, dogs were treated with steroids, NSAIDs (Meloxicam Inj.), or pentoses. Meloxicam Inj. was administered initially as a single dose at 0.2 mg/kg body weight intravenously or subcutaneously followed by, after 24 hours, Meloxicam oral suspension at the daily dose of 0.1mg/kg body weight, either mixed with food or placed directly in the mouth. Concurrently, if there are any crusts due to injury on the skin are gently removed with a brush and cleaned with sterile saline solution and wiped with dry sterile cotton.

2.5 Evaluation of study parameters

2.5.1 Clinical condition

The changes in scores of clinical condition assessment parameters viz. lameness, joint mobility, pain on palpation, weight bearing, and overall clinical condition were evaluated following supplementation of HJHF in order to assess the efficacy of HJHF in management osteoarthritic joint disorders, hip dysplasia, and fractures in dogs according to the grading system described in Table 1.[13]

Table 1: Clinical condition assessment parameters grading system

Parameters	Description	Score
A. Lameness	Walks normally	1
	Slightly lame when walking	2
	Moderately lame when walking	3
	Severely lame when walking	4
	Reluctant to rise and will not walk more than five paces	5
B. Joint Mobility	Full range of motion	1
	Mild limitation [10–20%] in range of motion; no crepitus	2
	Mild limitation [10–20%] in range of motion; with crepitus	3
	Moderate limitation [20–50%] in range of motion; ±crepitus	4
	Severe limitation [>50%] in range of motion; ±crepitus	5
C. Pain on Palpation	None	1
	Mild signs: dog turns head in recognition	2
	Moderate signs: dog pulls limb away	3
	Severe signs: dog vocalises or becomes aggressive	4
	Dogs will not allow palpation	5
D. Weight-bearing Score	Equal on all limbs standing and walking	1
	Normal standing: favors affect limb when walking	2
	Partial weight-bearing standing and walking	3
	Partial weight-bearing standing; non-weight-bearing walking	4
	Non-weight-bearing standing and walking	5

E. Overall Score of Clinical Condition	Not affected	1
	Mildly affected	2
	Moderately affected	3
	Severely affected	4
	Very severely affected	5

2.5.2 Clinical examination

The changes in scores of clinical examination assessment parameters viz. lameness, pain, reluctance to exercise, reluctance to climb upstairs, altered behavior, altered gait, altered range of motion (ROM), joint effusion, joint thickening, inactivity/stiffness, and muscle atrophy were evaluated following supplementation of HJHF in order to assess the efficacy of HJHF in management osteoarthritic joint disorders, hip dysplasia, and fractures in dogs according to the grading system described in the Table 2.

Table 2: Clinical examination parameters grading system

Parameters	Description	Score
A. Lameness Score	Present	2
	Absent	1
B. Pain Score	Present	2
	Absent	1
C. Reluctance to Exercise Score	Yes	2
	No	1
D. Reluctance to Climb Upstairs Score	Yes	2
	No	1
E. Altered Behavior Score	Yes	2
	No	1
F. Altered Gait Score	Yes	2
	No	1
G. Altered Range of Motion of Score	Yes	2
	No	1
H. Joint Effusion Score	Present	2
	Absent	1
I. Joint Thickening Score	Present	2
	Absent	1
J. Inactivity / Stiffness Score	Yes	2
	No	1

K.	Muscle Atrophy Score	Present	2
		Absent	1

Both clinical condition and clinical examination assessment parameters were assessed before supplementation (day 0) and subsequently on day 15, day 30, day 45, day 60, day 75, and day 90.

2.6 Assay of biochemical parameters

The blood sample (approximately 2ml) was collected in plain centrifuge tube (vacutainer tube) and serum was separated and stored at -20°C until assay of biochemical parameters. The blood sample was collected from the jugular vein of dogs.

The complete blood count and assay of serum biochemical parameters viz. creatinine, blood urea nitrogen (BUN), serum glutamic pyruvic transaminase (SGPT), serum glutamic oxaloacetic transaminase (SGOT), and alkaline phosphatase (ALP) were measured by using standardized kit-based assay methods.

2.7 Statistical analysis

The data are expressed as Mean ± SD. Data were subjected to one-way ANOVA followed by Dunnett's multiple comparison *post-hoc* test to draw the comparison between before treatment (day 0) and during the days of treatment i.e. day 15, day 30, day 45, day 60, day 75, and day 90. Students t-test was used to compare completed blood count and serum biochemical parameters between before and after supplementation of HJHF. $p \leq 0.05$ was considered as statistically significant.

III. RESULTS

The findings of clinical condition assessment parameters viz. lameness, joint mobility, pain, and weight-bearing scores significantly ($p<0.05$) decreased as early as from day 30 following supplementation of HJHF along with standard treatment. However, complete recovery of dogs from respective clinical conditions was observed following 90 consecutive days supplementation of HJHF. Consequently, the overall clinical condition score was significantly ($p<0.001$) improved as early as on day 30 and returned to normalcy on day 90 (Table 3).

Table 3: Supplementation effect of HJHF on clinical condition assessment parameters

Parameter	Day 0	Day 15	Day 30	Day 45	Day 60	Day 75	Day 90
Lameness score	5.00 ± 0.00	4.30 ± 0.48	***2.60 ± 1.78	***2.60 ± 1.26	***1.60 ± 0.70	***1.40 ± 0.70	***1.00 ± 0.00
Joint mobility score	4.50 ± 0.53	4.50 ± 0.53	***2.40 ± 1.51	***2.40 ± 0.97	***1.50 ± 0.53	***1.20 ± 0.42	***1.00 ± 0.00
Pain on score	4.20 ± 0.92	4.00 ± 1.05	***2.30 ± 1.42	***2.10 ± 1.20	***1.50 ± 0.53	***1.10 ± 0.32	***1.00 ± 0.00
Weight-bearing score	3.70 ± 1.42	3.20 ± 1.75	*2.60 ± 1.78	***2.00 ± 1.05	***1.50 ± 0.53	***1.10 ± 0.32	***1.10 ± 0.32
Overall clinical condition score	4.00 ± 1.05	3.90 ± 0.99	3.60 ± 0.84	***2.90 ± 0.32	***1.30 ± 0.48	***1.20 ± 0.42	***1.10 ± 0.32

Values are expressed as Mean ± SD; n=10

*p<0.05 and ***p<0.001 as compared to day 0 based on repeated measures one-way ANOVA followed by Dunnett's multiple comparison post-hoc Test

The scores of clinical examination parameters viz. lameness, pain, reluctance to exercise & climbing upstairs, altered behaviour, altered gait, altered ROM, joint effusion, joint thickening, and muscle atrophy were significantly improved (p<0.001) as early as 30 consecutive days supplementation of dogs with HJHF along with standard treatment. However, complete alleviation from respective clinical examination parameters was observed following 90 consecutive days supplementation of HJHF along with standard treatment in dogs (Table 4).

Table 4: Supplementation effect of HJHF on clinical examination assessment parameters

Parameter	Day 0	Day 15	Day 30	Day 45	Day 60	Day 75	Day 90
Lameness Score	1.90 ± 0.32	***1.40 ± 0.52	***1.30 ± 0.48	***1.20 ± 0.42	***1.10 ± 0.32	***1.10 ± 0.32	***1.10 ± 0.32
Pain on Palpation Score	2.00 ± 0.00	1.90 ± 0.32	***1.50 ± 0.53	***1.20 ± 0.42	***1.20 ± 0.42	***1.10 ± 0.32	***1.00 ± 0.00
Reluctance to Exercise Score	2.00 ± 0.00	1.90 ± 0.32	***1.20 ± 0.42	***1.00 ± 0.00	***1.00 ± 0.00	***1.00 ± 0.00	***1.00 ± 0.00
Reluctance to Climb Upstairs Score	2.00 ± 0.00	1.90 ± 0.32	***1.40 ± 0.52	***1.10 ± 0.32	***1.10 ± 0.32	***1.10 ± 0.32	***1.10 ± 0.32
Altered Behavioural Score	2.00 ± 0.00	***1.50 ± 0.53	***1.00 ± 0.00	***1.00 ± 0.00	***1.00 ± 0.00	***1.00 ± 0.00	***1.00 ± 0.00
Altered Gait Score	2.00 ± 0.00	***1.40 ± 0.52	***1.20 ± 0.42	***1.20 ± 0.42	***1.10 ± 0.32	***1.10 ± 0.32	***1.10 ± 0.32
Altered Range of Motion Score	1.90 ± 0.32	1.60 ± 0.52	**1.40 ± 0.52	***1.20 ± 0.42	***1.10 ± 0.32	***1.10 ± 0.32	***1.10 ± 0.32
Joint Effusion Score	2.00 ± 0.00	1.80 ± 0.42	***1.40 ± 0.52	***1.10 ± 0.32	***1.10 ± 0.32	***1.00 ± 0.00	***1.00 ± 0.00
Joint Thickening Score	1.90 ± 0.32	1.60 ± 0.52	***1.30 ± 0.48	***1.10 ± 0.32	***1.10 ± 0.32	***1.10 ± 0.32	***1.10 ± 0.32
Inactivity / Stiffness Score	1.80 ± 0.42	1.80 ± 0.42	***1.30 ± 0.48	***1.00 ± 0.00	***1.00 ± 0.00	***1.00 ± 0.00	***1.00 ± 0.00
Muscle Atrophy Score	1.90 ± 0.32	*1.60 ± 0.52	***1.10 ± 0.32	***1.00 ± 0.00	***1.00 ± 0.00	***1.00 ± 0.00	***1.00 ± 0.00
Lameness Score	1.90 ± 0.32	***1.40 ± 0.52	***1.30 ± 0.48	***1.20 ± 0.42	***1.10 ± 0.32	***1.10 ± 0.32	***1.10 ± 0.32

Values are expressed as Mean ± SD; n=10
*p<0.05, **p<0.01, and ***p<0.001 as compared to day 0 based on repeated measures one-way ANOVA followed by Dunnett's multiple comparison post-hoc Test.

The neutrophil (%) was significantly ($p<0.05$) reduced after supplementation of HJHF. However, there was no significant ($p>0.05$) effect on other complete blood count parameters and serum biochemical parameters were observed after supplementation of HJHF in dogs (Table 5).

Table 5: Supplementation effect of HJHF on complete blood count and biochemical parameters

Parameters	Before Supplementation	After Supplementation
RBC, mill/μm^3	6.56 ± 0.72	6.60 ± 0.67
Hb, g/dL	15.63 ± 3.91	14.90 ± 2.06
MCV, μm^3	63.71 ± 2.52	63.74 ± 2.77
MCHC, %	22.52 ± 0.91	22.64 ± 0.88
PCV, %	41.82 ± 4.56	42.44 ± 4.77
TLC, Cells/µL	10560.00 ± 3390.04	10940.00 ± 3820.52
Neutrophils, %	65.30 ± 5.55	*64.70 ± 5.97
Lymphocytes, %	28.90 ± 5.52	28.90 ± 6.01
Eosinophils, %	3.90 ± 0.70	3.60 ± 1.02
Monocytes, %	2.10 ± 0.30	1.80 ± 0.98
Platelet Count, lakh	2.33 ± 0.46	2.58 ± 0.45
Creatinine, mg/dL	2.47 ± 4.19	1.19 ± 0.41
Blood urea nitrogen, mg/dL	13.86 ± 2.69	13.98 ± 2.98
SGPT, U/L	53.30 ± 48.61	64.20 ± 63.80
SGOT, U/L	63.90 ± 48.07	72.80 ± 60.77
ALP, U/L	145.10 ± 19.11	150.90 ± 20.11

Values are expressed as Mean ± SD; n=10
*$p<0.05$ based on paired t-test

IV. Discussion

The primary aim of this study was to evaluate the safety and effectiveness of HJHF in managing osteoarthritic joint disorders, hip dysplasia, and fractures in dogs. The findings indicated that HJHF was safe and well-tolerated at the recommended usage quantity, with no significant changes observed in complete blood count or serum biochemical parameters. The improvement seen in dogs with hip dysplasia, osteoarthritis, and other joint-related conditions following HJHF supplementation may be attributed to the anti-arthritic, antirheumatic, anti-inflammatory, and analgesic properties of its herbal constituents namely Boswellia serrata, Cissus quadrangularis, Zingiber officinale, and Ananas comosus.

Evidence from the literature suggests that Z. officinale possesses notable anti-inflammatory and analgesic properties. Drozdov et al., reported that extracts of Z. officinale exhibited analgesic effects comparable to Diclofenac 100mg in patients with OA.[14] Additionally, other studies have shown that the analgesic effects of Z.

officinale extracts were similar to those of Ibuprofen and Indomethacin, with improvements in pain scores observed across all three treatments.[15-17] Srivastava and Mustafa demonstrated that powdered Z. officinale exerted a therapeutic effect in musculoskeletal and rheumatic conditions by inhibiting the cyclooxygenase and lipoxygenase pathways in synovial fluid.[18]

Furthermore, in a carrageenan-induced paw edema rat model, Hassan et al., found that oral administration of aqueous Z. officinale extract at 400 mg/kg body weight led to a significant reduction ($p<0.001$) in paw edema compared to the control group. They further reported that gingerol, shogaol, and related compounds in Z. officinale suppress prostaglandin and leukotriene biosynthesis by inhibiting 5-lipoxygenase and prostaglandin synthetase, confirming its anti-inflammatory effects.[11] Other researchers have also documented that gingerol and shogaol inhibit the production of pro-inflammatory cytokines, including IL-1, TNF-α, and IL-8.[19,20]

Research reports indicate that A. comosus has diverse medicinal properties, including anti-inflammatory,[21] antirheumatic,[22] and immunomodulatory effects.[23] Kargutkar and Brijesh confirmed its anti-inflammatory activity by demonstrating that A. comosus leaf extract inhibited carrageenan-induced paw edema in rats. They proposed that the mechanism involves inhibition of protein denaturation, suppression of proteinase activity, and reduced synthesis of TNF-α, IL-1β, PGE2, and ROS.12 Bromelain, a key compound found in the fruit and stem of A. comosus, has been extensively studied and reported to exhibit anti-inflammatory and analgesic effects.[24-26] Furthermore, Akhtar et al., demonstrated that treatment with a combination of bromelain, trypsin, and rutin produced pain and inflammation reduction comparable to Diclofenac.[27]

A systematic review and meta-analysis by Yu et al. reported that B. serrata and its extracts can alleviate pain, reduce WOMAC (Western Ontario and McMaster Universities Arthritis Index) scores for pain and stiffness, and improve joint function. They concluded that B. serrata is a safe and effective treatment option for OA, recommending a minimum treatment duration of four weeks.[9] These findings align with the outcomes of the current study.

Boswellic acids, the active constituents of B. serrata, have been shown to possess potent pharmacological activity in treating inflammatory conditions such as rheumatoid arthritis, chronic bronchitis, asthma, and inflammatory bowel disease. Among these, 3-O-Acetyl-11-keto-beta-boswellic acid (AKBA) is particularly noteworthy for its strong inhibitory action on 5-lipoxygenase (5-LOX).9 Clinical studies have demonstrated that B. serrata extract provides anti-inflammatory and anti-arthritic benefits while also improving pain and physical function.[28-30] In-vitro studies further revealed that B. serrata extract can inhibit the expression of inflammatory mediators such as adhesion molecules.[31-33]

C. quadrangularis is a well-established herbal remedy for bone-related disorders. Multiple studies, involving both animal models and human subjects, have confirmed its role in treating bone fractures, osteoporosis, and maintaining bone density. These studies suggest that the plant contains unidentified anabolic steroids that act through estrogenic receptors in bone tissue, thereby promoting early ossification and bone remodeling. This activity enhances metabolism and facilitates the rapid absorption of essential minerals such as calcium, sulfur, and strontium by osteoblasts.[34]

The methanolic extract of C. quadrangularis has demonstrated significant analgesic and anti-inflammatory properties. In mice, it notably reduced acetic acid-induced writhing and significantly decreased licking time during both phases of the formalin test, indicating both central and peripheral analgesic effects. In rats, it inhibited edema formation induced by ethyl phenylpropionate, carrageenan, and arachidonic acid, further supporting its anti-inflammatory potential.[35]

Furthermore, ethanolic extract of C. quadrangularis was also evaluated for analgesic, anti-inflammatory, and antipyretic activities in albino rats. Results showed a significant decrease in carrageenan-induced edema and effective pain relief in the formalin test, suggesting both central and peripheral mechanisms of action.[36] Similarly, studies using ethyl acetate extracts reported strong inhibition of lipopolysaccharide (LPS)-induced nitric oxide (NO) production. The extract suppressed mRNA expression and inducible nitric oxide synthase (iNOS) proteins, with its inhibitory effects reversed by the HO-1 inhibitor zinc protoporphyrin IX (ZnPP), highlighting a specific mechanism of action.[37]

V. CONCLUSION

The findings of this preliminary study demonstrated that supplementation of the "Herbal Joint Health-care Formulation" along with regular feed contributed to maintaining joint health and mobility in dogs. The formulation supports overall musculoskeletal wellness through its natural ingredients known for promoting flexibility, strength, and comfort. Therefore, supplementation of Herbal Joint Health-care Formulation at 1 tablet daily may be recommended as a nutritional feed supplement for dogs to help maintain healthy joints and support normal movement. Further studies are warranted to explore its role in long-term joint health and overall wellbeing in canines.

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References

[1] B. N. Lindler, K. E. Long, N. A. Taylor, and W. Lei, "Use of Herbal Medications for Treatment of Osteoarthritis and Rheumatoid Arthritis," Medicines (Basel), 7(11), 2020, 67.

[2] C. M. Mortellar, "Pathophysiology of osteoarthritis. Veterinary research communications," 27(1), 2003, 75-8.

[3] K. L. Anderson, D. G. O'Neill, D. C. Brodbelt, D. B. Church, R. L. Meeson, D. Sargan, J. F. Summers, H. Zulch and L. M. Collins, "Prevalence, duration and risk factors for appendicular osteoarthritis in a UK dog population under primary veterinary care," Sci Rep. 8(1), 2018, 1-2.

[4] W. C. Renberg, "Pathophysiology and management of arthritis," Vet Clin Sm Anim, 35, 2005, 559-64.

[5] S. D. Bland, "Canine osteoarthritis and treatments: a review," Vet Sci Dev, 5, 2015, 5931.

[6] M. Epstein, I. Rodan, G. Griffenhagen, J. Kadrlik, M. Petty, S. Robertson, and W. Simpson, "2015 AAHA/AAFP Pain Management Guidelines for Dogs and Cats," J Am Anim Hosp Assoc., 51(2), 2015, 67-84.

[7] B. KuKanich, "Outpatient oral analgesics in dogs and cats beyond non-steroidal anti-inflammatory drugs: An evidence-based approach," Vet Clin North Am Small Anim Pract., 43, 2013, 1109–1125.

[8] M. L. Cardeccia, L.H. Elam, K. A. Deabold, E. L. Miscioscia, and J. L. Huntingford, "A pilot study examining a proprietary herbal blend for the treatment of canine osteoarthritis pain," Can Vet J., 63(1) 2022, 55-62.

[9] G. Yu, W. Xiang, T. Zhang, L. Zeng, K. Yang, and J. Li, "Effectiveness of Boswellia and Boswellia extract for osteoarthritis patients: a systematic review and meta-analysis," BMC Complement Med Ther., 20(1), 2020, 225.

[10] H. S. Hamid, and S. A. Patil, "phytochemical and pharmacological review of an Indian plant: Cissus quadrangularis," Med Sci Forum, 2023, 21:20.

[11] N. A. Hassan, R. Karunakaran, and S. A. Uma, "Anti-inflammatory effect of Zingiber officinale on Sprague Dawley rats," Asian J Pharm Clin Res., 10(3), 2017, 1-3.

[12] S. Kargutkar, and S. Brijesh, "Anti-inflammatory evaluation and characterization of leaf extract of Ananas comosus," Inflammopharmacology, 26(2), 2018, 469-77.

[13] G. McCarthy, J. O'Donovan, B. Jones, H. McAllister, M. Seed, and C. Mooney, "Randomised double-blind, positive-controlled trial to assess the efficacy of glucosamine/chondroitin sulfate for the treatment of dogs with osteoarthritis," Vet J., 174(1), 2007, 54-61.

[14] V. N. Drozdov, V. A. Kim, E. V. Tkachenko, and G. G. Varvanina, "Influence of a specific ginger combination on gastropathy conditions in patients with osteoarthritis of the knee or hip," J Altern Complement Med., 18(6), 2012, 583-8.

[15] M. Haghighi, A. Khalvat, T. Toliat, and S. H. Jallaei, "Comparing the effects of ginger (Zingiber officinale) extract and ibuprofen on patients with osteoarthritis," Arch Iran Med., 8(4), 2005, 267-71.

[16] A. Haghighi, N. Tavalaei, and M. B. Owlia, "Effects of ginger on primary knee osteoarthritis," Indian J Rheumatol, 1(1), 2006, 3-7.

[17] R. D. Altman, and K. C. Marcussen, "Effects of a ginger extract on knee pain in patients with osteoarthritis," Arthritis Rheum, 44(11), 2001, 2531-8.

[18] K. C. Srivastava, and T. Mustafa, "Ginger (Zingiber officinale) in rheumatism and musculoskeletal disorders," Med Hypotheses, 39(4), 1992, 342-8.

[19] E. Tjendraputra, V. H. Tran, D. Liu-Brennan, B. D. Roufogalis, and C. C. Duke, "Effect of ginger constituents and synthetic analogues on cyclooxygenase-2 enzyme in intact cells," Bioorganic Chem., 29, 2001, 156–63.

[20] S. K. Verma, M. Singh, P. Jain, and A. Bordia, "Protective effect of ginger, Zingiber officinale Rosc on experimental atherosclerosis in rabbits," Indian J Exp Biol., 42, 2004, 736–8.

[21] E. R. Secor Jr, I. V. Carson WF, M. M. Cloutier, L. A. Guernsey, C. M. Schramm, C. A. Wu, and R. S. Thrall, "Bromelain exerts anti-inflammatory effects in an ovalbumin-induced murine model of allergic airway disease," Cell Immunol, 237(1), 2005, 68-75.

[22] S. Kargutkar, and S. Brijesh, "Anti-rheumatic activity of Ananas comosus fruit peel extract in a complete Freund's adjuvant rat model," Pharm Biol., 54(11), 2016, 2616-22.

[23] C. R. Engwerda, D. Andrew, A. Ladhams, and T. L. Mynott, "Bromelain modulates T cell and B cell immune responses in vitro and in vivo," Cell Immunol, 210(1), 2001, 66-75.

[24] S. Brien, G. Lewith, A. Walker, S. M. Hicks, and D. Middleton, "Bromelain as a treatment for osteoarthritis: a review of clinical studies," Evid Based Complement Alternat Med., 1(3), 2004, 251-7.

[25] R. Pavan, S. Jain, and A. Kumar, "Properties and therapeutic application of bromelain: a review" Biotechnol Res Int., 2012, 1-5.

[26] H. R. Maurer, "Bromelain: biochemistry, pharmacology and medical use," Cell Mol Life Sci., 58(9), 2001, 1234-45.

[27] N. M. Akhtar, R. Naseer, A. Z. Farooqi, and W. Aziz, and M. Nazir, "Oral enzyme combination versus diclofenac in the treatment of osteoarthritis of the knee: a double-blind prospective randomized study," Clin Rheumatol, 23(5), 2004, 410-5.

[28] P. K. Perera, M. Perera, and N. Kumarasinghe, "Effect of Sri Lankan traditional medicine and Ayurveda on Sandhigata Vata (osteoarthritis of knee joint)," Ayu., 35, 2014, 411–5.

[29] M. R. Shah, C. S. Mehta, V. D. Shukla, A. R. Dave, and N. N. Bhatt, "A Clinical study of Matra Vasti and an ayurvedic indigenous compound drug in the management of Sandhigatavata (Osteoarthritis)," Ayu., 31(2), 2010, 210-7.

[30] P. K. Gupta, S. M. Samarakoon, H. M. Chandola, and B. Ravishankar, "Clinical evaluation of Boswellia serrata (Shallaki) resin in the management of Sandhivata (osteoarthritis)," Ayu., 32(4), 2011, 478-82.

[31] S. Roy, S. Khanna, H. Shah, C. Rink, C. Phillips, H. Preuss, G. V. Subbaraju, G. Trimurtulu, and A. V. Krishnaraju, "Bagchi M, Bagchi D, Sen CK. Human genome screen to identify the genetic basis of the anti-inflammatory effects of Boswellia in microvascular endothelial cells," DNA Cell Biol., 24(4), 2005, 244-55.

[32] K. Sengupta, T. Golakoti, A. Marasetti, N. V. Rao, K. Palakurthi, S. P. Raychaudhuri, S. K. Raychaudhuri, A. K. Panda, A. V. Krishnaraju, and G. Trimurtulu, "30% 3-O-acetyl-11-keto-β boswellic acid inhibits TNFα production and blocks MAPK/NFκB activation in lipopolysaccharide-induced THP-1 human monocytes," J Food Lipids, 16, 2009, 325-44.

[33] A. V. Krishnaraju, D. Sundararaju, U. Vamsikrishna, R. Suryachandra, G. Machiraju, K. Sengupta, and G. Trimurtulu, "Safety and toxicological evaluation of Aflapin: a novel Boswellia-derived anti-inflammatory product," Toxicol Mech Methods, 20(9), 2010, 556-63.

[34] P. S. Bafna, P. H. Patil, S. K. Maru, and R. E. Mutha, "Cissus quadrangularis L: A comprehensive multidisciplinary review," J Ethnopharmacol, 279, 2021, 114355.

[35] A. Panthong, W. Supraditaporn, D. Kanjanapothi, T. Taesotikul, and V. Reutrakul, "Analgesic, anti-inflammatory and venotonic effects of Cissus quadrangularis Linn.," J Ethnopharmacol., 110(2), 2007, 264-70.

[36] P. Vijay, and R. Vijayvergia, "Analgesic, anti-inflammatory and antipyretic activity of Cissus quadrangularis," J Pharm Sci Res. 2, 2010, 64-71.

[37] K. Srisook, M. Palachot, N. Mongkol, E. Srisook, and S. Sarapusit, "Anti-inflammatory effect of ethyl acetate extract from Cissus quadrangularis Linn may be involved with induction of heme oxygenase-1 and suppression of NF-κB activation," J Ethnopharmacol, 133(3), 2011, 1008-14.