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Evaluation of the Efficacy of Mobility Plus® in the Management of Osteoarthritis and Joint Inflammation in Canines

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ABSTRACT

Background: Joint health is very vital in canines. Immediate attention and diagnosis will help to prevent suffering in canines. This study was designed to evaluate the *in vivo* efficacy of the poly-herbal formulation Mobility Plus® for arthritis, inflammation and analgesic activities in canines.

Methods: A total of 18 client-owned dogs with a history of joint inflammation, hip dysplasia and arthritis were selected (n=18) and supplemented with one tablet of Mobility Plus® daily until complete recovery. The changes in assessment parameters scores, *viz.* lameness score, joint mobility score, pain on palpation score, weight-bearing score and the overall clinical condition score were evaluated. The results revealed that lameness, joint mobility, pain and weight-bearing scores significantly (p<0.001) decreased in dogs as early as day 15; hence, the overall clinical condition score also decreased significantly (p<0.001) as early as day 15 after Mobility Plus® supplementation.

Result: Present study revealed that lameness, joint mobility, pain and weight-bearing scores significantly (p and lt; 0.001) decreased in dogs as early as day 15; hence, the overall clinical condition score also decreased significantly (p and lt; 0.001) as early as day 15 after Mobility Plus® supplementation. Supplementation of Mobility Plus® has antiarthritic and anti-inflammatory activities. Mobility Plus® could be recommended for the amelioration of joint inflammation and osteoarthritis conditions in canines.

Key words: Arthritis, Joint mobility, Lameness, Pain, Poly-herbal formulation.

INTRODUCTION

Osteoarthritis is a type of joint inflammation caused by the crumbling of the joint ligament. It is exceptionally common in most overweight canines and large breed canines (Aragon *et al*., 2007; Paster *et al*., 2005; Smith *et al*., 2006). Some breeds, such as Labrador Retriever and German Shepherd are even hereditarily inclined to have joint inflammation (Anderson *et al*., 2018). Osteoarthritis is accompanied by chronic pain, lameness and stiffness, particularly after prolonged activity. Their quality of life is reduced, leading to the loss of joint functions and mobility.

At present, there are no fixed treatments and the pharmacological treatment is restricted to the amelioration of clinical signs. Thus, the remedial administration for osteoarthritis in canines is overwhelmed by nonsteroidal anti-inflammatory drugs (NSAIDs), which are just ready to treat the manifestations of osteoarthritis by diminishing the pain and inflammation (Curry *et al*., 2005; Innes *et al*., 2003). In any case, the utilisation of NSAIDs might be related to hindering impacts, particularly gastrointestinal unfavourable impacts (Buttgereit *et al*., 2001). Other than pain relief, forestalling the ligament debasement is a significant goal for treatment and requires the long-term utilisation of safe modalities. Indeed, the absence of any cure reinforces the importance of prevention (Innes *et al*., 2003).

For these reasons, alternative treatments for canine osteoarthritis are desirable. Recently, nutraceuticals have been proposed for this purpose (Innes *et al*., 2003; Colitti *et al*., 2012; Henrotin *et al*., 2005). In addition, some herbal medicinal products have been shown to interact with the mediators of inflammation and therefore may be used to treat osteoarthritis (Cameron *et al*., 2009). These products can also act as free radicals through other mechanisms. However, up to now, few clinical trials have been carried out to substantiate the efficacy of herbal medicinal products.

With this scenario and the growing acceptance of traditional herbal preparations, the poly-herbal formulation Mobility Plus® was developed by Himalaya Wellness Company (Bengaluru, India). Mobility Plus® claims to possess antiarthritic, anti-inflammatory and analgesic activities in dogs. Hence, this study assessed the *in vivo* efficacy of Mobility Plus® in managing osteoarthritis and joint inflammation in dogs.

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MATERIALS AND METHODS

Poly-herbal formulation

Mobility Plus® is a proprietary poly-herbal formulation developed by Himalaya Wellness Company. It is composed mainly of shunti (*Zingiber officinale*), lasuna (*Allium sativum*), avocado (*Persea americana*), soybean (*Glycine max*), ananas (*Ananas comosus*) and guggul (*Commiphora wightii*).

Ethical committee approval

This study was conducted according to the guidelines for the care and use of animals. The study protocol was approved by the Institutional Animal Ethics Committee, Himalaya Wellness Company, Protocol No. AHP/SA/10/18 Institutional Ethics Committee.

Study subjects

A total of 18 client-owned dogs with a history of joint inflammation, hip dysplasia and arthritis, presented at Ganesh Pet Clinic, Bengaluru, Karnataka, India, were enrolled in the study. The study was conducted for the period of eight months from October 2018 to May 2019. The study details, treatment plan, outcomes and pros and consequences were explained to the pet owner and consent was obtained before enrolling them in the study.

Study design and experimental details

A total of 18 client-owned dogs with a history of joint inflammation, hip dysplasia and arthritis were selected (n=18) and supplemented with one tablet of Mobility Plus® until complete recovery. The dogs were used as their own controls and, therefore, allocated to a control pre-treatment period (0 days), followed by a treatment period (45 days). Efficacy of the product was judged based on the recovery from pain and inflammation (Improvement in assessment parameters scores). Based on the severity of the disease, dogs were treated with Meloxicam injection. Meloxicam injection was administered initially as a single dose at 0.2 mg/kg body weight intravenously or subcutaneously. Concurrently, any crusts due to skin injury were gently removed with a brush, cleaned with sterile saline solution and wiped with dry sterile cotton. When Mobility Plus® was administered to the dogs, concurrent treatment with another analgesic, antipyretic and anti-inflammatory supplements was not followed.

Evaluation of the study parameters

The changes in assessment parameters scores, *viz.* lameness score, joint mobility score, pain on palpation score and weight-bearing score and the overall clinical condition score were evaluated after supplementation with Mobility Plus® to assess its role in the management of osteoarthritis and joint disorders in dogs according to the grading system (McCarthy *et al.*, 2007), as described in Table 1.

Statistical analysis

Data were expressed as mean ± standard error of the mean and subjected to two-way analysis of variance followed by

Table 1: Assessment parameters grading system.

Parameters	Description	Score
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
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
Pain on palpation	None	1
	Mild signs; dog turns head in recognition	2
	Moderate signs: dog pulls limb away	3
	Severe signs: dog vocalizes or becomes aggressive	4
	The dog does not allow palpation	5
Weight-bearing score	Equal on all limbs standing and walking	1
	Normal standing: favors affected 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
Overall clinical condition score	Not affected	1
	Mildly affected	2
	Moderately affected	3
	Severely affected	4
	Very severely affected	5

Bonferroni test to draw the comparison between before treatment (day 0) and during treatment (*i.e.*, days 15, 30 and 45). P value, $p \leq 0.05$, was considered statistically significant.

RESULTS AND DISCUSSION

Existing medications, such as NSAIDs, for the management of inflammation are not viable given their severe adverse effects, *viz*. bleeding and ulceration. Colchicine and corticosteroids are related to an expanded danger of toxic signs along with severe complications, such as bone marrow demolition and deterioration of liver or kidney cells (Schlesinger. 2004). For the best possible control and alleviation of inflammatory reactions, natural products are used as therapeutic solutions to control the aggravation of osteoarthritis (Tanwar *et al*., 2015). Hence, this study evaluated the *in vivo* efficacy of Mobility Plus® in managing osteoarthritis and joint inflammation in dogs.

The assessment parameters scores *viz.* lameness, joint mobility, pain and weight-bearing scores, significantly ($p<0.001$) decreased in dogs as early as day 15 after supplementation with Mobility Plus® along with standard treatment; hence, the overall clinical condition score significantly ($p<0.001$) decreased as early as day 15 after Mobility Plus® supplementation. However, the complete amelioration of lameness, joint mobility, pain and weight-bearing was observed on day 45 (Table 2). The amelioration of lameness, joint mobility, pain and weight-bearing of dogs after supplementation could be attributed to the antiarthritic, anti-inflammatory and analgesic activities of Mobility Plus®.

The antiarthritic, anti-inflammatory and analgesic activities of Mobility Plus® could be understood by individual herbal ingredients, *viz. Z. officinale*, *A. sativum*, *P. americana*, *G. max*, *A. comosus* and *C. wightii*, present in Mobility Plus®. It has been reported that gingerol, shogaol and other structurally related substances in ginger inhibit prostaglandin and leukotriene biosynthesis by suppressing 5-lipoxygenase or prostaglandin synthetase (Hassan *et al*., 2017). These chemicals can also inhibit the synthesis of proinflammatory cytokines, such as interleukin (IL)-1, tumour necrosis factor-α (TNF-α) and IL-8 (Tjendraputra *et al*., 2001; Verma *et al*., 2004). Paw oedema in carrageenan-induced rats was considerably reduced by treatment with 400 mg/kg aqueous ginger extracts compared to untreated rats ($p<0.001$). Hence, it was understood from the findings of Hassan *et al.* (2017) that the aqueous extract of *Z. officinale* possesses anti-inflammatory properties.

A. sativum extract and its related phytochemicals have been reported to possess anti-inflammatory activity. Hobauer *et al*. (2000) and Gu *et al.* (2013) observed that the anti-inflammatory activity of *A. sativum* extracts is caused by inhibiting the emigration of neutrophilic granulocytes into the epithelia. Jeong *et al*. (2016) reported that aged black garlic (ABG) exhibited potent antioxidant activities and these activities were found responsible for its anti-inflammatory activity. Furthermore, they revealed that ABG chloroform extract acts by reducing nuclear factor-κB (NF-κB) activation in human umbilical vein endothelial cells caused by TNF-α. Moreover, ABG methanolic extract was reported to prevent cyclooxygenase-2 and prostaglandin E_2 (PGE_2) production by NF-κB inactivation.

In a prospective multicenter randomised control trial, Blotman *et al*. (1997) reported that 153 osteoarthritis patients treated with avocado/soybean unsaponifiables (ASU) along with NSAIDs for 45 days reduced the requirements of NSAIDs without significant changes in patients' pain scores. Ernst (2003) conducted three clinical trials to assess the effectiveness of ASU therapy on osteoarthritis patients and two of them demonstrated a reduction in Lequesne's functional index, pain and disability. Furthermore, more than 50% reduction in NSAID requirement was observed in 71% of the patients in the case group compared to control (36%) (Ernst, 2003). Maheu *et al*. (2014) reported no improvement in joint space width (JSW) during 3 years of follow-up in the hip in osteoarthritis patients on ASU therapy. However, 20% prevention of JSW aggravation was noticed.

Based on the literature, *A. comosus* possesses several medicinal properties, *viz*. anti-inflammatory (Secor *et al*., 2005), antirheumatic (Kargutkar and Brijesh, 2016) and other immunomodulatory (Engwerda *et al*., 2001). Kargutkar and Brijesh, (2016) confirmed the anti-inflammatory property of *A. comosus* leaf extract through its inhibitory effect on carrageenan-induced paw oedema in rats. Furthermore, these authors postulated that the possible mechanism of action of the anti-inflammatory activity of *A. comosus* leaf extract could be through the inhibition of protein denaturation, proteinase activity and synthesis of TNF-α, IL-1b, PGE_2 and reactive oxygen species (Kargutkar and Brijesh, 2018). The fruit and stem parts of *A. comosus* are rich sources of bromelain. Bromelain belongs to a group of

Table 2: Effect of Mobility Plus® on the assessment parameters in dogs.

Parameter	Day 0	Day 15	Day 30	Day 45
Lameness score	2.39±0.22	1.50±0.15***	1.00±0.00***	1.00±0.00***
Joint mobility score	2.61±0.24	1.67±0.20***	1.11±0.08***	1.00±0.00***
Pain score	2.44±0.23	1.67±0.18***	1.06±0.06***	1.00±0.00***
Weight-bearing score	2.28±0.19	1.56±0.15***	1.00±0.00***	1.00±0.00***
Overall clinical condition score	2.22±0.19	1.50±0.15***	1.06±0.06***	1.00±0.00***

Data are mean±SEM (n=18).

***$p<0.001$ compared to day 0 based on repeated-measures two-way ANOVA followed by Bonferroni test.

protein-digesting enzymes reported to possess antiarthritic, anti-inflammatory and analgesic properties. It has been recorded that treatment with the combination of bromelain, trypsin and rutin resulted in the reduction of pain and inflammation, which was at par when compared to diclofenac treatment (Akhtar *et al*., 2004). According to Brien *et al*. (2004) bromelain as a feed supplement could be recommended as an alternative treatment to NSAIDs. Mojcik and Shevach (1997) reported the pivotal role of bromelain in the pathogenesis of arthritis. In addition, bromelain has analgesic properties that are thought to be the result of its direct influence on pain mediators, such as bradykinin (Pavan *et al*., 2012; Maurer 2001).

Guggulsterone [4,17(20)-pregnadiene-3,16-dione] is a plant sterol derived from the gum resin (guggul) of the tree *C. wightii*. The resin of the *C. wightii* tree has been used in Ayurvedic medicine for centuries to treat diseases such as obesity, bone fractures, arthritis, inflammation, cardiovascular disease and lipid disorders (Urizar and Moore, 2003; Sinal and Gonzalez, 2002). Furthermore, literature reports evidenced the effectiveness of guggul for treating knee osteoarthritis (Khanna *et al*., 2007; Singh *et al*., 2003).

In summary, this study demonstrated that joint inflammation and osteoarthritis in dogs were ameliorated after supplementation with Mobility Plus® along with standard treatment through the antiarthritic and anti-inflammatory activities of the individual ingredients present in Mobility Plus®. Hence, this study provided considerable preliminary data that Mobility Plus® has antiarthritic and anti-inflammatory activities.

CONCLUSION

It was demonstrated that Mobility Plus® would play a major role in the management of osteoarthritis-induced inflammation through the antiarthritic and anti-inflammatory activities of individual ingredients present in Mobility Plus®. Hence, Mobility Plus® could be recommended for the amelioration of joint inflammation and osteoarthritis conditions in canines.

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