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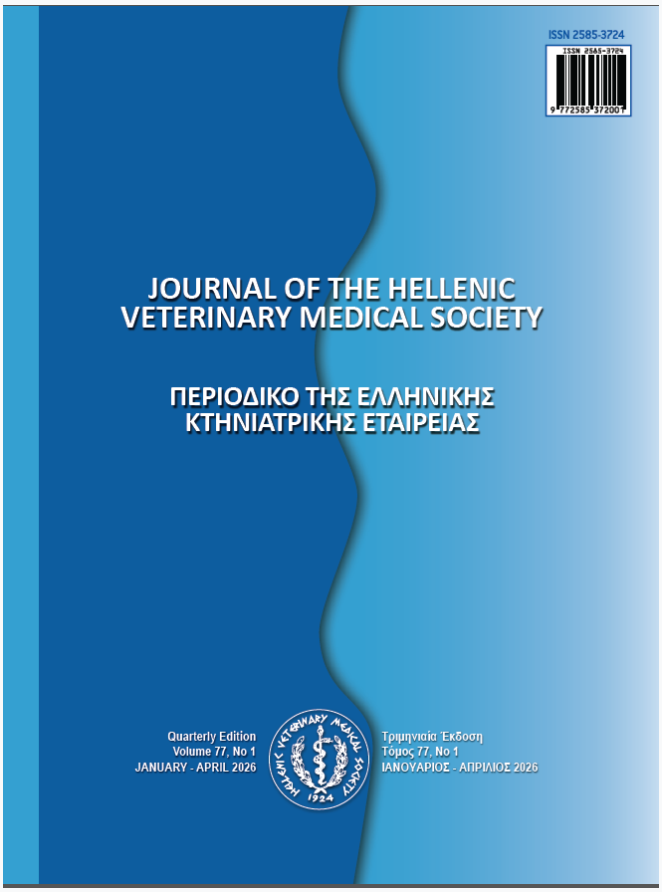

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Review article
Ανασκόπηση

The pharmacological and therapeutic effects of carprofen in dogs

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ABSTRACT: Carprofen, a propionic acid-derived non-steroidal anti-inflammatory drug (NSAID), is widely utilized in veterinary medicine for its anti-inflammatory, analgesic, and antipyretic effects in dogs. This review examines carprofen's pharmacological properties. It highlights the drug's selective COX-2 inhibition. This action decreases prostaglandin production. Importantly, it achieves this while limiting gastrointestinal toxicity risks. Pharmacokinetic studies highlight high oral bioavailability, hepatic glucuronidation, and renal excretion, with a half-life of 8–12 hours enabling once-daily dosing. Clinically, carprofen effectively manages osteoarthritis, post-operative pain, and inflammatory conditions, though caution is advised in patients with hepatic/renal impairment. Adverse effects, including gastrointestinal ulceration and rare hepatotoxicity, necessitate vigilant monitoring. Despite its established safety, concurrent use with corticosteroids or other NSAIDs requires careful risk-benefit assessment. Carprofen remains a cornerstone in canine pain management, balancing efficacy with a favorable safety profile when used judiciously.

Keyword: Carprofen; Pharmacokinetics; Pharmacodynamics ; Dogs

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INTRODUCTION

Carprofen belongs to the family of compounds, propionic acid and phenylalkanoic acid derivatives, included among non-steroidal anti-inflammatory drugs. Carprofen is a widely used veterinary medicine for the treatment of acute and chronic inflammatory conditions in dogs (Dumitrascu *et al.*, 2022) . The understanding of the pharmacological and therapeutic effects is of great relevance to a proper and safe use in practice. The authors speculate that a review article that broadens the knowledge and offers a basis to guide the daily clinical use was, in this area, expected by the veterinary practitioners. The purpose of this review is to summarize the knowledge of drug characteristics regarding pharmacokinetics and pharmacodynamics, therapeutic applications, safety (toxicity and clinical perspectives), and drug interactions of carprofen

The complexity of its pharmacological nature contributes to its immense value in the treatment of wild or exotic animals, as well as in the welfare of food-producing animals. Moreover, considering its already established safety profile, there is a compelling need for additional experimental studies specifically focused on these unique aspects(Serinelli *et al*., 2022). Through these endeavors, we can further unravel the true potential and benefits of carprofen in diverse animal populations. With its ability to tackle inflammation, relieve pain, and offer neuroprotective properties, carprofen is indispensable in ensuring the well-being and comfort of various animals. As research continues to explore the diverse implications and applications of carprofen, we are stepping closer to harnessing its full potential and discovering novel therapeutic uses(Maitra *et al.*, 2020) . By conducting further in-depth studies that encompass an array of animal populations, we can unlock the untapped benefits of this remarkable compound. The expanding body of knowledge surrounding carprofen will not only pave the way for enhanced treatment protocols but also contribute to the advancement of veterinary medicine as a whole(Dewsbury, 2021). The discussion will focus on the paramount aspects of this NSAID so that each information presented can be useful as a clinical guide on its daily use in practice.

HISTORICAL DEVELOPMENT OF CARPROFEN

During 1970s-1980s carprofen was synthesized as a part of propionic acid class of NSAIDs, structurally related to ibuprofen and naproxen. Initially investigated for human use. However, it was not pursued for human markets due to strategic decisions or insufficient advantage over existing drugs. Carprofen was not essentially unsafe or useless in humans but just lacked a competitive edge over existing NSAIDs. Its favorable pharmacokinetics and safety profile in dogs led to its repurposing as a veterinary drug, where it filled a critical therapeutic gap(PADALIYA *et al.*, 2024). Recognizing potential in veterinary medicine, particularly for dogs, researchers noted its satisfactory pharmacokinetics in canines, including longer half-life and reduced toxicity compared to human NSAIDs, which can be toxic to pets. In 1990s approved by the U.S.FDA under brand name Rimadyl, marketed by Pfizer Animal Health. This marked a milestone as one of the first NSAIDs specially developed for veterinary use, offering a safer alternative for managing osteoarthritis and postoperative pain in dogs. Post- approval, Rimadyl gained rapid popularity in veterinary practices, becoming a standard treatment(Fox and Johnston, 1997; Mitchell, 2005). Late 1990s /early 2000s saw reports of adverse effects (e.g., hepatotoxicity, gastrointestinal issues) in some dogs, promoting FDA-mandated label updates and increased veterinary vigilance(MacPhail *et al.*, 1998). These events underscored the importance of individualized dosing and monitoring. After patent expiration, generic carprofen become available, reducing costs and expanding access. While primarily used in dogs, off-label use in other species like cats is limited due to species-specific sensitives(Monteiro-Steagall *et al.*,2013).

Dosage forms of carprofen

Carprofen is available in several formulations to accommodate different clinical needs and ease of administration in veterinary practice, primarily for dogs. The common dosage forms include:

1. Oral Tablets/Caplets:
   Chewable Tablets: Flavored beef or liver to improve palatability and compliance.
   Non-Chewable tablets/Caplets: For dogs that may resist chewable.
2. Injectable Solution:
   Administrated subcutaneously by veterinaries, typically for postoperative pain management
   Oral Granules: Some formulations may come as granules to mix with food , though this is less common (Schmitt and Guentert, 1990; Fox and Johnston, 1997).

Pharmacokinetics of Carprofen

Absorption: carprofen demonstrate excellent bioavailability when administered orally, with approx-

imately 90% of the drug absorbed in dogs. Peak plasma concentrations (C_{mac}) are achieved within 1-3 hours post-administration, regardless of formulations (chewable tablets, caplets, or granules). While food intake may delay the time to Cmax by slowing gastric emptying, it does not significantly reduce overall absorption, allowing flexibility in dosing with or without meals. Subcutaneous injection, typically used in clinical settings for postoperative pain, ensures rapid systemic availability, with comparable absorption kinetics to oral routes(Fox and Johnston, 1997).

Distribution: carprofen is highly (>90%) , primarily to albumin, which restricts its free fraction in plasma and limits passive diffusion into tissues. However, its moderate volume of distribution (Vd: 0.1–0.2 L/kg) reflects adequate penetrations into target tissues, including inflamed joints and synovial fluid(De Vito, 2018) . This tissue specificity enhances its anti-inflammatory action at sites of pathology while minimizing systemic exposure. Notably, carprofen's distribution is influenced by physiological factors such as hypoalbuminemia, which may increase free drug levels and necessitate dose adjustments in comprised patients(Nebel-Karp *et al.*, 2024).

Metabolism: carprofen undergoes hepatic metabolism, with glucuronidation serving as the primary pathway in dogs. This process conjugates carprofen into an inactive metabolite, carprofen glucuronide, which is excreted via bile. A minor fraction is oxidized by cytochrome P 450 enzymes (CYP2C9/19), producing metabolites with negligible pharmacological activity. Acritical feature of carprofen is its racemic composition, containing both R- and S- enantiomers(Nebel, 2023). In dogs, the R-enantiomer is the therapeutically active form, preferentially inhibiting cyclooxygenase-2 over cyclooxygenase-1. Unlike humans, dogs exhibit minimal chiral inversion (conversion of R-to S- enantiomer), reducing the risk of COX1- mediated gastrointestinal toxicity(Ravuri *et al.*, 2022). This enantioselective metabolism contributes to carprofen's favorable safety profile in canine. Dogs efficiently glucoronidate carprofen, facilitating safe elimination. In contrast, cats lack robust glucuronidation capacity, leading to prolonged half-lives and accumulation of toxic metabolites. Consequently, carprofen is contraindicated in felines. Similarly, humans metabolize carprofen more extensively via oxidation, underscoring the importance of specific-specific drug development(Priymenko *et al.*, 1998).

Excretion: Elimination of carprofen is predominantly hepatic, with 60-70% of the drug excreted in feces as glucuronidated metabolites. Renal excretion accounts for the remaining 30-40% , primarily as unchanged drug. The elimination half-life ranges from 8-12 hours in healthy dogs, supporting one- or twice-daily dosing regimens. Enterohepatic recirculation of carprofen glucuronide may prolong its presence in systemic circulation, though this has limited clinical significance under normal dosing protocols(Priymenko *et al.*, 1998).

Geriatric dogs or those with hepatic/renal disorder may exhibit reduced clearance, necessitating dose reductions. Dosing should be based on lean body weight to avoid overdosing, as carprofen does not distribute significantly into adipose tissue. Concurrent use of highly protein-bound drugs(e.g., furosemide) may displace carprofen, increasing free drug levels. Combining NSAIDs or corticosteroids potentiates the risk of adverse effects like gastrointestinal ulceration(Priymenko *et al.*, 1998).

Carprofen's pharmacokinetic profile informs its dosing strategy (2-4 mg/kg once daily) and therapeutic monitoring. Its prolonged half-life and high bioavailability enable convenient dosing, while preferential COX-2 inhibition minimizes GIT toxicity compared to non-selective NSAIDs. However, idiosyncratic hepatotoxicity, though rare, warrants vigilance in long-term use(Nebel, 2023).

Carprofen in lactating dogs exhibited enantiomer-specific pharmacokinetics with elevated clearance (R: 95.81mL/h/kg; S 73.87 mL/h/kg) and elimination half-lives (~7 hours). Minimal milk transfer (milk: plasma ratio<1) and neonatal plasma concentration (10% maternal levels) confirmed low neonatal exposure risk(Nebel-Karp *et al.*, 2024). Carprofen exhibited bioequivalent total exposure (AUC) between oral and subcutaneous routes in dogs, despite lower subcutaneous peak concentrations(C_{max}). Steady-state AUC met bioequivalence criteria, supporting interchangeable use for therapeutic efficacy, while C_{max} differences suggest route dependent absorption kinetics(Clark *et al.*, 2003). A novel transdermal ketoprofen formulation (20% ketoprofen) demonstrated prolonged absorption in dogs, with a terminal half-life of 25.77± 22.15 h and mean residence time of 41.63± 32.33 h after transdermal administration, compared to 4.69 h abd 4.86 h for intravenous dosing. Bioavailability was ~7%, with a 30-minute lag-time. Total systemic exposure (AUC) for transdermal ketoprofen was 8.13 μg·h/mL versus 15.75 μg·h/mL

for IV , indicating sustained but lower absorption (Ravuri *et al.*, 2022).

MECHANISM OF ACTION

Carprofen is a non-narcotic, non-steroidal anti-inflammatory drug that exerts anti-inflammatory, analgesic, and antipyretic action through inhibition of COX enzymes, which are responsible for prostaglandins production(Burch *et al.*, 2021).There are two isoforms of cyclooxygenase enzymes identified today that possess a similar structure: the constitutively expressed COX-1 isoenzyme and the inducible COX-2 isoenzyme. Both COX isoenzymes regulate the conversion of arachidonic acid into prostaglandin endoperoxides, which is a key early step in the production of a variety of pro-inflammatory mediators. The enzyme inhibition caused by carprofen leads to a decrease in pro-inflammatory prostaglandins. This, in turn, results in the decline of the perception of pain and its transmission in the central nervous system (CNS), while the inflammation reduction inhibits the migration and actions of inflammatory mediators and white blood cells(Gómez-Segura *et al.*, 2020). In addition, the widening of blood vessels leading to increased heat is obstructed as implicated by prostaglandins, providing the substance of antipyresis activity of carprofen(Nganvongpanit *et al.*, 2020). Carprofen is relatively selective for COX-2, but it has been shown that the drug is also capable of lowering COX-1 activity in high concentrations. This might explain gastrointestinal ulceration observed in animals receiving higher doses(Kumar, 2009; Garcia-de la Virgen *et al.*, 2024). However, at the typical therapeutic concentration of 1–2 μg/mL, the inhibition of COX-1 by carprofen is relatively low, reaching only 60% even after 72 hours of application(Lees, 2009). The COX-1/COX-2 selectivity of carprofen should be taken into account, because most cases of gastrointestinal ulcers are likely to be due to the inhibition of the COX-1 isoenzyme. Furthermore, updated experiments and studies show the participation of arachidonic acid metabolic pathways other than the cyclooxygenase and the involvement of local cytokines or chemokines not directly regulated by prostaglandins(Sawyere, 2016).

ANTI-INFLAMMATORY EFFECTS

Carprofen effectively attenuates the unfortunate sequel associated with inflammation. Numerous clinical studies have demonstrated the ability of Carprofen to ameliorate inflammation in various tissues of dogs(Thau-Zuchman *et al.*, 2012; Jäckel *et al.*, 2024). It has been shown that there is direct evidence of rapid onset of action(Mercer *et al.*, 2023). At a molecular level, Carprofen enhances cartilage regeneration, partially through immunosuppression. These studies demonstrate that Carprofen is effective in ameliorating inflammation resulting from a variety of causes and in various species(Toholova *et al.*,2024).

Carprofen reduces inflammatory complications resulting from administration of the bacterium lipopolysaccharide in dogs, the endotoxin lipoteichoic acid in dogs, lipopolysaccharide in horses, gonadectomy in dogs, prolonged exposure to corticosteroids in dogs, cranial cruciate ligament rupture in dogs, periodontal inflammation in dogs, a new surgical implant in calves, and soft tissue and intra-articular surgical trauma in dogs, pigs, horses, and rabbits(Hernández-Avalos *et al.*, 2020) . In these species, pain-associated inflammation possibly results from excitatory allostatic inflammation and anti-inflammatory effects of opioids. Differences in clinical performance between Carprofen and other COX-2 inhibitors may be due to differences in pharmacokinetics, pharmacodynamic profiles, degree of COX-2 selectivity, and the somewhat unproven existence of clinically significant COX-1-derived prostaglandins(Mercer, Davis and McKenzie, 2023).The clinical importance of such differentiation is becoming more evident. Strategies that remove or suppress the inflammatory stimulus are important adjuncts and have clinical relevance in the management of inflammatory diseases. Reducing inflammation can facilitate analgesia and contribute to an improved quality of life postoperatively for these patients (Tai *et al.*, 2020).

ANALGESIC EFFECTS

Carprofen exerts its analgesic effect primarily by selectively inhibiting COX2 an enzyme upregulated during inflammation, COX-2 catalyzes the synthesis of prostaglandins, particularly PGE2, which sensitize peripheral pain receptors (nociceptors) to inflammatory mediators like bradykinin and histamine(Mathews, 2002; Obara *et al.*, 2020). By reducing prostaglandins production, carprofen diminishes pain signal transmission from inflamed tissues. Additionally, it may inhibit central prostaglandin synthesis in the spinal cord and brain, dampening pain perception. This dual peripheral and central action reduces inflammation-induced hyperalgesia (heightened pain sensitivity)(Thau-Zuchman *et al.*, 2012).

At a dose of 4.4 mg/kg daily oral in dogs, Carprofen has a half-life of 8 hours and greater than 80% bioavailability. At a dosage of 4.4 mg/kg

BID, it inhibits both COX-1 and COX-2 for 24 hours(PADALIYA *et al.*, 2024) . Recommended dosing to use its analgesic effects is 4.4 mg/kg oral, 1 dose 1 hour prior to surgery, and 4.4 mg/kg oral for 3 to 4 subsequent doses(Turk *et al.*, 2021). The first dose should be given 1 to 2 hours before surgery and the last dose at the end of the surgical period. The quick onset of action suggests that the drug may be used for acute pain. It is also suggested that it may be used prophylactically for surgery in long-term or chronic pain patients. It may also be used to reduce the dose of other analgesics, particularly narcotics, in order to achieve pain relief with fewer side effects(Kim *et al.*, 2020).

ANTIPYRETIC EFFECTS

Carprofen exert its antipyretic effect primarily by inhibiting cyclooxygenase enzyme, particularly COX-2, which is induced during inflammation. COX enzymes catalyze the synthesis of prostaglandins, including PGE2, a key mediator of fever(Liu *et al.*, 2024). Prostaglandin E2 acts on the hypothalamus to elevate the body's temperature set-point. By blocking COX2, carprofen reduces PGE2 production, thereby normalized hypothalamic signaling and lower fever(Lees, 2009). Its preferential COX-2 inhibition minimizes gastrointestinal side effects compared to non-selective NSAIDs. Additionally, carprofen may suppress pro-inflammatory cytokines that contribute to fever, enhancing its antipyretic action(Ospina *et al.*, 2024). This dual action -blocking PGE2 synthesis and dampening cytokine-driven pyrogenic signaling- enhances its antipyretic efficacy.

In a study done on febrile dogs, carprofen was shown to significantly decrease both core and surface temperatures from 12 hours after administration of a single subcutaneous dose. Core temperature remained significantly lower than the vehicle-treated group, up to six hours post-drug administration(Lagutchik, 2020).

CLINICAL APPLICATIONS

8.1 Osteoarthritis (OA) is one of the major clinical conditions in the dog. 8.2 Postsurgical Pain: Carprofen has been successfully used preventively in the management of postoperative pain in dogs during ovariohysterectomy, after orthopedic surgeries, and in the case of onychectomy. 8.3 Inflammatory diseases: Carprofen has been used as an adjunctive medication in the long-term treatment of encephalitozoonosis in rabbits and in dogs affected by exocrine pancreatic insufficiency (EPI) and, more rarely, as an antipyretic drug (Bays, 2020). In dogs, Carprofen has been added to the standard medical therapy for the treatment of leishmaniosis, thus contributing to the reduction of joint pain. 8.4 Others: Carprofen has been used for the treatment of sialometaplasia in dogs and conjunctivitis in rabbits(Morales *et al.*, 2007; Bays, 2020). For dogs, the recommended oral dose is 4 mg kg^{-1}. The dose is not licensed for other animal species. 8.5 Tolerance and effect monitoring: Long-term administration of Carprofen seems to be safe(Akyol and Gokbulut, 2024). Albeit further studies are needed, the clinical evidence showed that the welfare and quality of life of animals treated with Carprofen are significantly improved; this is particularly evident in the case of dogs. Osteoarthritic diseases usually worsen with age, and the prophylactic use of NSAIDs continuously for some years is considered by many dog owners(Buller *et al.*, 2020). The veterinarian commonly used corticosteroids and non-steroidal anti-inflammatory drugs (NSAIDs) when a compressive myelopathy was suspected(-Baka *et al.*, 2023). In cases of canine orchiectomy, the use of antibiotics and NSAIDs was essential as adjunct therapy to promote and accelerate wound healing(Yiapanis *et al.*, 2024).

ADVERSE EFFECTS AND CONTRAINDICATIONS

While carprofen is generally safe, there are several potential side effects to be aware of. The most common side effects are gastrointestinal, renal, and, to a lesser extent, hepatic. Gastrointestinal adverse effects range from mild gastritis to severe ulceration that can lead to perforation and secondary peritonitis, with the possibility of developing or exacerbating pre-existing inflammatory bowel disease. To minimize the risk of development of gastrointestinal ulcers and bleeding, it is advisable to give carprofen with food and in combination with proton-pump inhibitors(Mehra *et al.*, 2021; Liu *et al.*, 2024). Like all NSAIDs, carprofen may induce renal adverse effects due to inhibition of renal prostaglandins synthesis(Arfeen *et al.*, 2024).This may become a concern in dogs with pre-existing condition, like pre-renal azotemia, chronic kidney disease, hyperaldosteronism, hepatic disease, or dehydration. Veterinarians should carefully monitor renal values, especially with long-term users. Finally, all NSAIDs, including carprofen, can induce elevations in liver enzymes through pathways that are not well understood. Liver function should be assessed prior to beginning therapy to establish a baseline and monitor

values during long-term use(Mazumder *et al.*, 2024; Tsoupras *et al.*, 2024).

Carprofen is contraindicated in dogs with a known hypersensitivity to carprofen or other nonsteroidal anti-inflammatory drugs(Fox and Johnston, 1997). Adverse effects may include gastrointestinal ulcers, liver toxicity, kidney toxicity, and ocular toxicity in some animals. The use of carprofen in dogs with predisposing conditions may result in additional adverse reactions(Kholmurodovich, 2022). Concomitant administration of corticosteroids may increase the risk of developing serious gastrointestinal lesions, depression, hyperactivity, and/or anorexia(Bottero *et al.*, 2022).

Animals with clinical signs predisposing to decreased renal perfusion, impaired renal or hepatic function, or dehydration (e.g., due to gastrointestinal fluid losses in the presence of diarrhea or vomiting), as well as patients showing coagulation disorders or advanced heart failure, should be treated with carprofen only after careful benefit-risk assessment by the responsible veterinarian (Boothe, 2020). Ingestion of the product may result in the development of serious adverse effects, and in such cases, treatment requirements may be greater than in the case of other NSAIDs (Ferrari *et al.*, 2022). Case reports on carprofen intoxication indicate that the development of clinical signs may be observed 24-36 hours following ingestion. Clinical signs – slowed movement or lethargy, anorexia, vomiting, and dehydration – usually develop within two days, and renal failure may be seen within four days(Fick *et al.*,2020). Treatment with corticosteroids and other NSAIDs may exacerbate the symptoms. Management should include symptomatic and supportive therapy, hydration, and vomiting induction. Hemodialysis can result in complete recovery(Arca *et al.*, 2020). A randomized, blinded, placebo-controlled study assessed 22 dogs with osteoarthritis receiving oral carprofen (13) or placebo (9) for 8 weeks. Carprofen induced transient reductions in serum protein and albumin at 4 weeks, resolving by 8 weeks , without renal/ hepatic toxicity. Appetite improved in treated dogs, carprofen is well-tolerated long-term, with transient hypoalbuminemia potentially linked to altered gastrointestinal permeability(Raekallio *et al.*, 2006).

COMPARATIVE ANALYSIS WITH OTHER NSAIDS

In a blinded crossover study comparing acetaminophen-codeine (AC) and carprofen for managing sodium urate-induced lameness in dogs, carprofen significantly outperformed AC. Dogs receiving AC exhibited higher lameness scores and reduced ground reaction forces at 3-9 hours post-induction. Despite detectable effectively attenuated lameness, affirming its superiority for acute synovitis pain in dogs(Budsberg *et al.*, 2020). In a study comparing carprofen and firocoxib for post-operative pain management in 36 dogs undergoing orthopedic surgery, both NSAIDs showed comparable efficacy. Pain assessment via Hansen score card and lameness scoring revealed no significant differences between groups, with scores decreasing significantly over 90 days. Both drugs effectively reduced pain and lameness, supporting their use in clinical settings(PADALIYA *et al.*, 2024). In another study tepoxalin, carprofen and meloxicam for managing intraocular inflammation in 38 dogs with uveitis, tepoxalin significantly reduced aqueous PGE2 concentrations compared to carprofen and meloxicam. Tepoxalin's COX-1 preference and dual inhibition of COX and 5-lipoxygenase likely contributed to its superior efficacy, making it a viable option for treating canine anterior uveitis(Gilmour and Lehenbauer, 2009). A study evaluated the effects of aspirin, carprofen, deracoxib, and meloxicam on platelet function and prostaglandin levels in 10 healthy dogs. After 7- day treatments, most NSAIDs show no significant impact on platelet aggregation, thromboxane or prostacyclin concentrations. Deracoxib caused mild platelet aggregation reduction with low-dose ADP, while meloxicam slightly decreased fibrinogen (within normal range). Findings suggest minimal hemostatic disruption at therapeutic doses, though deracoxib's minor platelet effect warrants further investigation (Blois *et al.*, 2010).

DRUG INTERACTIONS

In general, Carprofen medication can influence or be influenced by the fact that the patient receives other medications at the same time. Several drug classes are considered for a drug interaction, involving an increased adverse event, pharmacokinetic and/or pharmacodynamic therapeutic response of one drug due to the other drug(Niu *et al.*,2019). For Carprofen, agents from other NSAID classes and/or corticosteroids are considered to induce possible additive side effects. A study evaluated carprofen and dexamethasone in a 3D canine chondrocyte model of osteoarthritis(OA) induced by interleukin(IL)-1β. Both drugs reduced PGE2, indicating anti-inflammatory effects, but minimally protected against IL-1β-induced chondrocyte death , matrix loss , or elevated matrix metalloprotease(MMP-3,

MMP-13). Dexamethasone impaired long-term vel viability and collagen type-II synthesis , while carprofen show no toxicity but lacked matrix-enhancing effects (Dvorak *et al.*, 2002).

With regard to the concomitant prescription of glucocorticoids with Carprofen, their synergistic effects on duodenal and colonic permeability, and extended platelet function half-life were evaluated. Until today, there are no studies on the potential of an interaction between Carprofen and other NSAID agents, such as acetaminophen, metamizole, and opioids (Rudolff, 2011). A study conducted on 15 dogs with canine inflammatory mammary carcinoma to evaluated the efficacy of carprofen and toceranib combination, the result showed that 60% of dogs treated stabilization of the disease, both drugs reduced pain over 90 days (Garcia-de la Virgen *et al.*, 2024). A dog with aggressive grade III/ stage IV mammary carcinoma underwent radical surgery and multimodal chemotherapy(carprofen, firocoxib , toceranib and chloraminophene). Survival reached 218 days with good quality of life, suggesting potential efficacy(Beaudu-Lange and Lange, 2024).

CONCLUSION

Carprofen, a propionic acid-derived NSAID, has established itself as cornerstone in veterinary medicine for managing pain and inflammation in dogs. This review underscores its pharmacokinetic advantages, including high oral bioavailability, selective COX-2inhibition, and enantioselective metabolism favoring therapeutic efficacy while minimizing gastrointestinal toxicity. Clinically, carprofen demonstrates robust anti-inflammatory, analgesic, and antipyretic effects, making it a versatile option for conditions such as osteoarthritis, postoperative pain, and inflammatory diseases. Its formulations oral tablets, injectables, and granules enhance compliance and adaptability in diverse clinical scenarios. Despite its favorable safety profile, carprofen is not without risks. Adverse effects, though less frequent than non-selective NSAIDs , include gastrointestinal ulceration, hepatotoxicity, and renal impairment, particularly in dogs with pre-existing conditions. The review emphasizes the necessity of individualized dosing, vigilant monitoring, and avoidance in cats due to specific-specific metabolic limitations. Drug interactions, particularly with corticosteroids and other NSAIDs warrant caution to present additive toxicity. Comparative analyses highlight carprofen's equivalence in efficacy to other veterinary NSAIDs, with distinct advantages in safety and pharmacokinetics. Future research should focus on long-term safety in diverse populations, including geriatric and comorbid patients, and explore novel formulations to optimize therapeutic outcomes. Overall, carprofen remains indispensable in enhancing canine welfare, provided its use is guided by evidence-based practices and tailored to individual patient needs.

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