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Platelet-Rich Plasma in Veterinary Wound Healing: Mechanisms, Applications, and Clinical Potential

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ABSTRACT

Wound healing is a significant challenge in both human and veterinary medicine, particularly in cases involving trauma, infection, or chronic tissue damage. Platelet-rich plasma (PRP), a product derived from the patient's own blood and enriched with growth factors and cytokines, has gained interest for its potential to promote regeneration and enhance healing. The present study aimed to evaluate current evidence on the application of PRP and its derivatives in wound healing, with a specific focus on veterinary animal models, and to identify key mechanisms, therapeutic outcomes, and existing knowledge gaps. While the present study highlighted veterinary applications, the included studies also consisted of rodent models, *in vitro* experiments, and human cell lines, providing broader mechanistic insights. A structured narrative review was conducted using 25 peer-reviewed articles published between 2024 and 2025. The selected studies included controlled trials, *in vitro* experiments, systematic reviews, and concept papers on PRP, platelet-rich fibrin, plasma rich in growth factors, and emerging formulations such as induced pluripotent stem cell-derived platelets and protein-rich PRP matrices. Key data related to study design, subjects, intervention types, outcomes, and theoretical frameworks were extracted and analyzed. All studies confirmed the positive role of PRP in promoting angiogenesis, collagen formation, epithelialization, and inflammation modulation. Evidence from veterinary models, including feline trauma cases and animal-derived PRP, supported the clinical applicability of PRP in wound healing. Several studies have demonstrated that the PRP approach is a valuable and effective treatment method in clinical practice, applicable to patients and animals. The PRP proved to be an efficacious intervention for cutaneous wounds, including surgical wounds, traumatic injuries, and chronic ulcers. However, differences in PRP preparation methods and outcome assessment criteria hinder direct comparisons across studies. Recent findings indicated new mechanisms involving telocytes and the regulation of vascular genes. It has been indicated that PRP and its derivatives are promising biological therapies for improving wound healing in veterinary practice.

Keywords: Growth factor, Platelet-rich plasma, Tissue repair, Veterinary medicine, Wound healing

INTRODUCTION

The process of wound healing is a highly coordinated and intricate physiological response that plays a vital role in restoring tissue structure and function after injury (Iacopetti et al., 2020). In veterinary practice, proper wound care is essential for ensuring animal health and well-being, particularly in situations involving traumatic injuries, burns, surgical wounds, or persistent ulcers (Accorroni et al., 2025; Li et al., 2025a). Unlike human clinical settings, veterinary wound care often faces additional challenges, including limited compliance, delayed diagnosis, and restricted access to advanced therapies, particularly in field or agricultural settings. These constraints require therapies that are accessible, cost-effective, and biologically active, capable of reliably accelerating healing and reducing complications such as infection, delayed wound closure, or excessive scarring (Accorroni et al., 2025).

One example of a biologically active treatment that is becoming increasingly popular is platelet-rich plasma (PRP). Platelet-rich plasma is a blood-derived product prepared from the patient's own blood, containing an elevated concentration of platelets in a limited volume of plasma (Farghali et al., 2024; Zhang et al., 2024; Rath et al., 2025). When platelets in PRP are activated, they release a rich combination of growth factors and cytokines that are crucial during the initial stages of tissue repair, including platelet-derived growth factor (PDGF), vascular endothelial growth

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factor (VEGF), transforming growth factor-beta (TGF-β), epidermal growth factor (EGF), and interleukins (Everts et al., 2020). These bioactive substances facilitate angiogenesis, stimulate fibroblast migration, increase collagen synthesis, and promote epithelial cell proliferation, thereby supporting and expediting tissue repair (Farghali et al., 2024; Zhang et al., 2024). Similar effects on epithelialization have been reported by Aragosa et al. (2025) using leukocyte- and platelet-rich fibrin (L-PRF). In both human and animal models, such as dogs and cats, PRP and PRF have demonstrated efficacy in managing acute and chronic wounds, cartilage and bone injuries, and post-surgical recovery (Zhang et al., 2024; Vidal-Negreira et al., 2025).

Despite encouraging clinical applications, there is significant variability across studies in PRP preparation protocols, cellular content, and therapeutic outcomes (Everts et al., 2020; Rath et al., 2025; Seidel et al., 2025). This inconsistency is particularly problematic in veterinary practice, where species-specific responses demand reliable, well-established protocols. Without consistency, veterinarians face challenges in predicting treatment efficacy, ensuring reproducible outcomes, and developing evidence-based guidelines tailored to different animal species. These challenges are particularly pronounced in veterinary medicine, where differences across species and the limited number of clinical trials make interpretation even harder. Some studies have emphasized the regenerative potential of leukocyte-rich PRP, while Carr et al. (2024) have recommended leukocyte-poor formulations to mitigate inflammation. Furthermore, Farghali et al. (2024) highlighted that PRP facilitates tissue repair in dogs by modulating the wound microenvironment through the complex delivery of growth factors and cytokines, a primary mechanism of action in clinical wound management.

In veterinary settings, recent experimental studies have explored the effects of PRP and PRF on wound healing in feline and canine trauma models, revealing improvements in collagen deposition, granulation tissue formation, and epithelial closure without significant adverse effects (Zhang et al., 2024; Wang et al., 2025a). Additionally, the use of PRP derived from alternative sources, such as induced pluripotent stem cell (iPSC)-derived megakaryocytes (iMPs) or even animal donors, such as deer, presented further opportunities and prompted questions about scalability, safety, and effectiveness across species (Kosaka et al., 2024; Jasim et al., 2025).

Given the growing yet fragmented evidence base, there is a critical need for a structured review focused specifically on PRP's role in veterinary wound healing. The present study aimed to integrate current clinical and preclinical evidence on PRP use in domestic and companion animals, elucidate its mechanisms of action in animal models, and evaluate its therapeutic potential and limitations to support the development of standardized, evidence-based protocols in veterinary medicine.

SEARCH CRITERIA

The present narrative literature review aimed to synthesize current evidence on the use of PRP in wound healing, with a focus on veterinary applications. Relevant studies were identified through searching on Scopus, PubMed, and Web of Science, conducted between January 1, 2024, and December 31, 2025, and a total of 25 peer-reviewed articles were included and studied for the present investigations. Additionally, reference lists of selected articles were manually screened to ensure comprehensive coverage. Search terms included combinations of platelet-rich plasma or PRP, platelet-rich fibrin or PRF, wound healing, tissue regeneration, skin repair, veterinary, and animal model. Only peer-reviewed articles published in English and indexed in Scopus, PubMed, and Web of Science were considered.

The inclusion criteria were applied to identify studies evaluating the effectiveness of PRP in wound healing or relevant to veterinary medicine that reported outcomes such as healing rate, histological changes, or inflammation markers. Studies involving animal models or veterinary clinical cases were included in the present study. Editorials, conference abstracts, non-peer-reviewed articles, studies involving only human subjects, and studies not related to animal models or veterinary clinical cases were excluded from the present study.

Data extracted from each study included authorship, year, design, animal model, PRP type and preparation, wound type, outcomes, and key findings. The details of the included studies, including species, PRP preparation techniques, treatment protocols, and outcomes, are summarized in Table 1. Results were categorized based on mechanisms of action, veterinary uses, technological innovations, and models. A qualitative synthesis was conducted by comparing study outcomes, identifying common patterns, and highlighting research gaps across the included studies. Figure 1 illustrates the literature review process flow diagram, depicting the main stages and sub-stages involved in article selection and review.

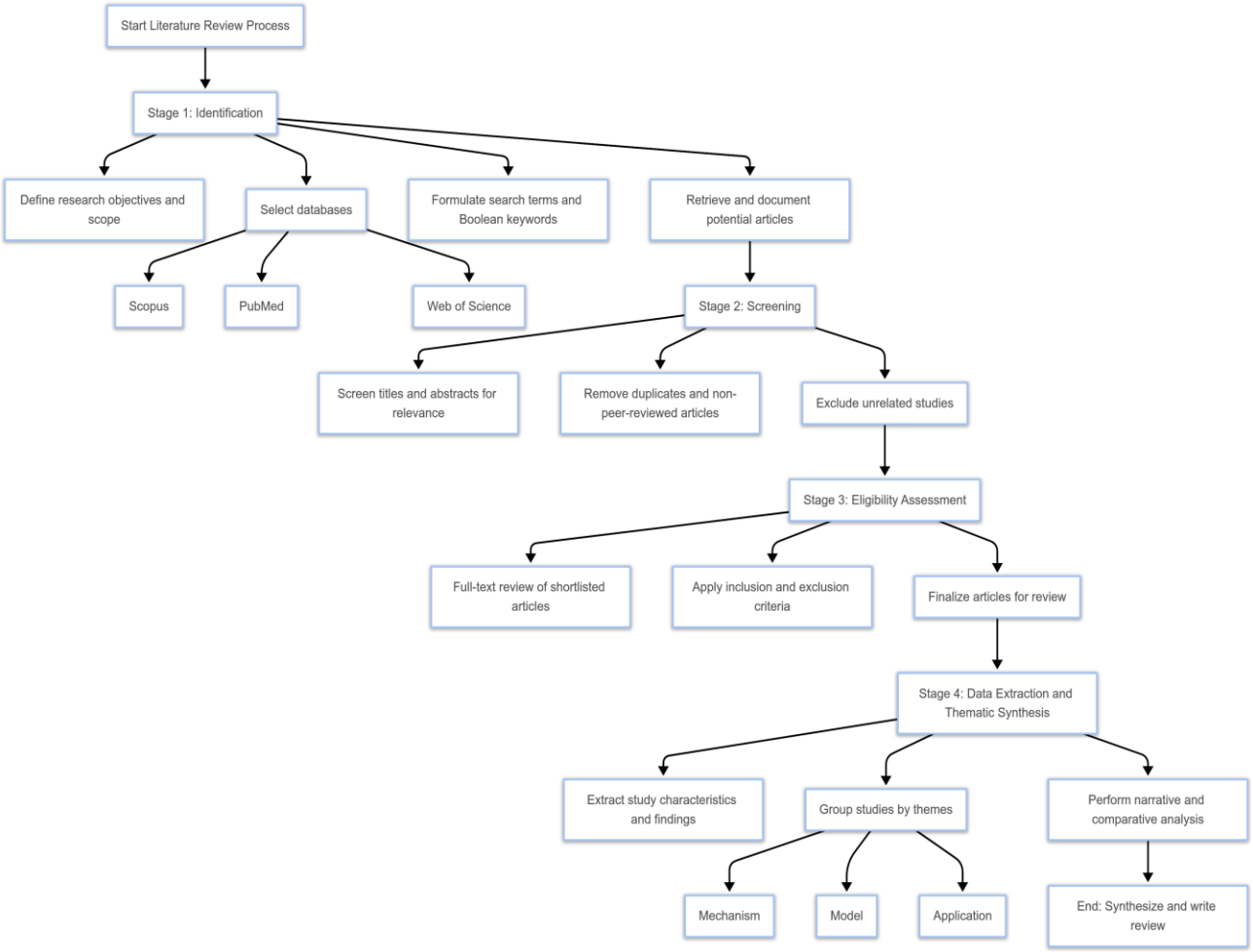

Figure 1. Process of selecting studies on platelet-rich plasma in veterinary wound healing published from 2024 to 2025. The flow diagram shows the stages and sub-stages of conducting the present review article on wound healing with platelet-rich plasma in 2024-2025. Source of the image: Authors of the present study.

MECHANISMS AND CLINICAL APPLICATIONS OF PLATELET-RICH PLASMA IN VETERINARY WOUND HEALING

Platelet-rich plasma mechanisms of action in wound repair

The reviewed studies provided robust evidence for the therapeutic potential of PRP and its derivatives to enhance wound healing in both human and veterinary contexts. Previous studies established PRP as a biologically active treatment that facilitates multiple important aspects of tissue repair, including angiogenesis, collagen synthesis, re-epithelialization, and modulation of inflammation (Figure 2; Pitafi, 2024; Jasim et al., 2025; Rath et al., 2025). The PRP applications across different animal models demonstrated enhanced wound healing, including angiogenesis, collagen synthesis, and epithelial regeneration. Variations in preparation techniques, treatment protocols, and outcomes for PRP have made it challenging to establish standardized guidelines for its use in veterinary wound management. These differences included differences in PRP preparation methods, such as single- or double-centrifugation protocols, leukocyte-rich versus leukocyte-poor PRP, and the use of activated or non-activated PRP (Everts et al., 2020; Rath et al., 2025).

Additionally, treatment protocols differed among studies, including topical application, intralesional injection, PRF gel, PRF membrane, or PRP combined with wound dressings (Pitafi, 2024; Soares et al., 2024). For instance, in feline trauma or skin wound models, platelet-rich fibrin was applied directly to the wound surface to improve re-epithelialization and wound contraction (Zhang et al., 2024). In feline skin graft models, PRP was combined with tilapia fish bio-dressing to support graft healing and tissue repair (Abellisa et al., 2024; Etriwati et al., 2025). In rat wound models, different PRP-based biomaterials were used to enhance wound repair. Hjazi (2025) reported that a PRP-loaded dermal matrix scaffold improved collagen deposition and wound healing in diabetic rats, whereas Li et al. (2025b) used a reactive oxygen species-responsive hydrogel to activate PRP and promote antibacterial activity and diabetic wound

closure in rats. Panigrahi et al. (2025) demonstrated that a PRP-functionalized iron oxide nanoparticle hydrogel accelerated healing in a rat excisional wound model, while Wang et al. (2025b) demonstrated that PRP-derived exosome-encapsulated hydrogels enhanced diabetic wound healing by reducing fibroblast ferroptosis. The translational potential of advanced PRP formulations, including iPSC-derived platelets, exosome-loaded hydrogels, and nanoparticle scaffolds, remains largely confined to experimental settings. Furthermore, the shift toward advanced regenerative medicine strategies has successfully identified specific molecular pathways that not only accelerate re-epithelialization but also minimize aesthetic scarring in complex wound models (Dutra Alves et al., 2025). Moreover, outcomes differed across studies; some studies assessed macroscopic wound closure rates, whereas others evaluated microscopic parameters, including histopathological healing scores, collagen deposition, angiogenesis, epithelialization, inflammatory cell infiltration, and granulation tissue formation.

Growth factor profiles and molecular pathways

Previous studies confirmed that platelet-derived products, such as PRP and PRF, are rich in growth factors, including PDGF and VEGF, which are crucial for wound healing (Farghali et al., 2024; Kosaka et al., 2024; Zhang et al., 2024). Furthermore, Kosaka et al. (2024) identified TGF-β and Insulin-like growth factor-1 (IGF-1) in PRP, while Zhang et al. (2024) indicated that PRF contains TGF-β1 and fibroblast growth factor 2 (FGF2) in a feline trauma model. These findings demonstrated that autologous platelet-derived products, including PRP and PRF, prepared from the patient's own blood, can accelerate wound healing in cats by improving wound closure, tissue perfusion, growth factor production, inflammation control, and collagen fiber formation, thereby highlighting their therapeutic potential in feline wound management (Figure 3; Angelou et al., 2022; Zhang et al., 2024). Similarly, Kosaka et al. (2024) found that iMPs outperformed conventional PRP in promoting angiogenesis and collagen deposition in diabetic mice, suggesting that platelet source and the standardization of wound-healing processes may influence therapeutic outcomes. The PRP facilitates wound healing by delivering different growth factors and cytokines that modulate the local microenvironment (Farghali et al., 2024). Beyond this traditionally accepted mechanism, new approaches in regenerative medicine have further proposed an expanded cellular model, suggesting that less well-characterized cellular components, such as telocytes, may act as potential mediators of PRP-induced regeneration. Everts et al. (2024) reviewed the biological properties of protein-rich platelet-rich plasma (PR-PRP) matrices and highlighted their potential for sustained growth factor release and recruitment of regenerative cells based on previous *in vitro* and *in vivo* studies. These findings indicated that platelet-derived products (PRP, PRF, and L-PRF) aid wound healing by releasing VEGF and PDGF to stimulate angiogenesis and TGF-β to enhance collagen deposition and tissue remodeling (Farghali et al., 2024; Zhang et al., 2024; Aragosa et al., 2025).

Furthermore, recent evidence indicated that PRP modulated the inflammatory stage of wound healing by regulating key pro- and anti-inflammatory cytokines, including interleukin-1 beta (IL-1β), IL-6, IL-10, and tumor necrosis factor alpha (TNF-α). Studies have indicated that PRP affects macrophage polarization and activity, thereby creating a more favorable microenvironment for tissue repair and regeneration across different animal models (Carr et al., 2024; Zhang et al., 2024; Wang et al., 2025a). Feline PRF and animal-derived PRP extract have been demonstrated to influence wound healing by regulating immune responses, promoting fibroblast proliferation, stimulating new blood vessel formation (angiogenesis), enhancing collagen deposition, and supporting epithelial regeneration (Zhang et al., 2024; Wang et al., 2025a). Additionally, these findings further supported the use of PRP as a regenerative therapy for wound management in veterinary patients, as reported by Wang et al. (2025a), who demonstrated that PRP derived from deer blood exhibited superior antioxidant capacity, wound-healing performance, and anti-inflammatory properties *in vitro*. While deer are not common laboratory models, Wang et al. (2025a) highlighted potential applications of PRP derived from wildlife species as a future therapeutic biomaterial. The study conducted by Zhang et al. (2024) provided direct experimental evidence supporting the use of PRF in cats, whereas the findings of Wang et al. (2025a) on deer-derived PRP introduced new possibilities for developing species-specific, animal-based PRP formulations. The mechanisms underlying PRP efficacy in non-conventional models, including wildlife species such as deer and novel cellular mediators such as telocytes, were poorly explored. In a comparative analysis, Watanabe et al. (2025) found that plasma rich in growth factor (PRGF), a variant of leukocyte-poor PRP, elicited higher proliferation rates in gingival epithelial cells than leukocyte-rich PRP, thereby underscoring the role of leukocyte content in shaping PRP effects.

These studies made a meaningful contribution to the understanding of PRP's regenerative capacity and support its continued exploration as a therapeutic tool in both clinical and veterinary contexts.

Table 1. Selected studies on platelet-rich plasma and its derivatives in animal wound healing (2024-2025)

Author (Year)	Design	Subjects/Model	Intervention	Outcomes	Mechanisms of action	Inconsistencies/gaps
Abellisa et al. (2024)	Controlled laboratory experimental animal study	Local cats (*Felis catus domesticus*), auto skin graft	PRP + Tilapia Mozambique skin bio-dressing, evaluating blood parameters on different days	The PRP group demonstrated significantly higher platelet dynamics and stable erythrocyte indices	PRP as a biologic adjunct modulated systemic platelet response during graft healing, and hematological parameters remain within physiological ranges	Very small sample size, no PRP-only group, outcomes limited to hematological findings, and short follow-up period
Farghali et al. (2024)	Experimental / *In vivo* study	Canine model (dogs with full-thickness skin defects)	Comparison of single-dose inactivated autologous PRP, laser therapy, and a PRP/laser combination	The combined PRP/laser therapy yielded the fastest healing potential, superior granulation tissue, and optimized remodeling	Synergistic effects occur when combining mechanical/photostimulation (laser) with autologous growth factors	Small sample size, long-term cosmetic outcomes (hair regrowth/scar texture)
Zhang et al. (2024)	Controlled animal trial	18 feline model (cats with induced skin trauma)	Topical application of autologous PRF on skin wounds	PRF improved healing, collagen formation, and reduced inflammation	Confirmed that autologous PRF acted as an effective bioscaffold that provided sustained growth factor release specifically optimized for feline skin physiology	Small sample size and no long-term follow-up
Kosaka et al. (2024)	*In vitro* + diabetic mouse model	HUVECs, fibroblasts, diabetic mice	Application of human iPSC-derived megakaryocytes and platelets	iMPs superior in wound closure, angiogenesis, and growth factor release	Transitioning from exclusively autologous donor-dependent harvesting to scalable, standardized off-the-shelf cellular therapies utilizing stem cell technology	Clinical use of iMPs is not yet established
Everts et al. (2024)	Theoretical/conceptual review	Not applicable (technical synthesis)	Analysis of advanced protein-rich, PRP matrices as multi-purpose biological platforms	Described scaffolding role, sustained GF delivery, PPP growth factors such as IGF-1, HGF	Highlights PR-PRP as a structural and biochemical scaffold	Mostly theoretical, lacks direct clinical application data
Wang et al. (2025a)	*In vitro* (animal-sourced PRP)	Keratinocytes + animal PRP (deer)	Evaluation and screening of heterologous / animal-derived PRP extracts from various animal species (with a focus on deer blood)	Deer PRP had the highest healing, antioxidant, and anti-inflammatory effects	Animal PRP is viable, deer PRP promising for veterinary/cosmetic use	Ethical concerns, translation to live models is limited
Seidel et al. (2025)	Practical review	Equine	Medium-term storage of platelet-derived orthobiologics.	Validated that medium-term storage was feasible, making platelet products more readily available for timely field application	Point-of-care limitations can be mitigated by optimizing preservation and storage protocols for biologics	Exact degradation rates of specific growth factors across different storage intervals require further molecular quantification
Vidal-Negreira et al. (2025)	Systematic review and quality evaluation	Dogs undergoing orthopedic treatments	Analysis of liquid- versus gel-based PRP therapies in veterinary orthopedic surgery.	Reported benefits in tissue repair and orthopedic recovery, but the evidence quality varied	Increasing veterinary use of PRP, heterogeneity in preparation protocols influenced outcomes	Lack of standardization in PRP preparation, dosage, and administration, and inconsistent methodological quality
Wang et al. (2025b)	Translational mechanistic experimental design (*in vitro* + controlled animal study)	Human diabetic fibroblasts, diabetic mouse wound model	PRP-derived exosome-encapsulated hydrogels applied to diabetic cutaneous wounds	Accelerated healing in mice via inhibition of fibroblast ferroptosis	Targeting cell-death pathways in chronic wounds	Complex intervention limited direct clinical scalability
Aragosa et al. (2025)	Prospective study	Veterinary cases of chronic wounds	Autologous L-PRF membranes	Marked reduction in wound surface area, control of local infection, and accelerated closure of stubborn, chronic wounds	Leukocyte inclusion provided an added antimicrobial benefit alongside the regenerative properties of fibrin	L-PRF required immediate processing and application, difficult to use in emergency/unprepared clinical settings

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Li et al. (2025a)	Controlled comparative animal infection model	Rats with infected burn wounds (dual-species biofilm)	Comparative topical application of PRP, PRF, and AG on wounds infected with a dual-species biofilm (*Pseudomonas aeruginosa* and *Staphylococcus aureus*)	Reduced bacterial burden, increased collagen, and reduced inflammation	Highlighting the powerful, innate antibacterial and antibiofilm properties of platelet concentrates, which can outperform traditional topical antimicrobials (such as silver) in complex, polymicrobial wound environments	No long-term outcomes or clinical confirmation
Rath et al. (2025)	Conceptual synthesis of mechanistic and clinical heterogeneity (methodological review design)	Multidisciplinary PRP studies	Systemic evaluation of PRP isolation methods, chemical/physical activation pathways, and diverse clinical applications	Provided a definitive structural blueprint establishing how specific processing steps alter growth factor cascades, leukocyte retention, and final therapeutic outcomes	Lack of protocol standardization was a key determinant	Did not resolve optimal dose or formulation
Carr et al. (2024)	Literature review	Canine (dogs)	PRP products are used as orthobiologic agents.	Significant support for PRP efficacy, particularly in treating canine osteoarthritis and soft tissue injuries.	Platelet-derived growth factors strongly promote tissue regeneration and reduce localized inflammation.	High variability in PRP preparation protocols (centrifugation speeds, leukocyte counts) across different studies
Li et al. (2025b)	Controlled bioengineering-animal experimental design	Diabetic infected rat wound model	ROS-responsive photo-crosslinked double-network hydrogel (HTC/MCP) loaded with PRP.	High levels of ROS at the wound site trigger the dynamic borate ester bonds to dissociate. This automatically releases on-demand antibacterial agents and activates the encapsulated PRP, reaching nearly 95% wound closure in rats in 14 days by promoting fibroblast migration and tissue microvascular density.	Precision-controlled PRP delivery	Manufacturing and regulatory barriers
Soares et al. (2024)	Review/book chapter	Dogs and cats	PRF therapy for traumatic skin wounds	The fibrin matrix allowed sustained release of growth factors, thereby accelerating dermal matrix repair	PRF was emerging as a superior, scaffold-free autologous option compared to traditional PRP for skin-specific trauma	Limited larger-scale, RCTs specifically comparing PRF directly against advanced synthetic dressings in cats
Panigrahi et al. (2025)	Controlled nanocomposite animal experiment	Rat excisional wound model	Biosynthesized iron oxide nanoparticles encapsulated within a chitosan/alginate hydrogel and functionalized with PRP	Synergistic action accelerated epithelialization and tissue cross-linking. The green-synthesized iron oxide nanoparticles provided localized antimicrobial/antioxidant defense, while the integrated PRP drove cellular proliferation and rapid dermal remodeling.	PRP-enhanced multifunctional biomaterials	Long-term biosafety unknown
Hjazi (2025)	Randomized controlled animal intervention study	Diabetic Sprague-Dawley rats	Bioactive, biodegradable 3D DDM scaffold enriched with PRP	Significantly accelerated wound closure rates by Day 14. The DDM-PRP combination enhanced extracellular matrix deposition, upregulated VEGF and TGF-β expression, and promoted structural hair follicle regeneration and epidermal thickness	PRP was the most effective treatment	While structural and histomorphometric tissue markers were highly favorable on Day 14, the long-term metabolic degradation rate of the DDM scaffold across varying degrees of diabetes severity remains uncharacterized.
Etriwati et al. (2025)	Controlled experimental animal study	9 male domestic cats (*Felis catus*), auto skin graft	Group I: moist dressing (control), Group II: Tilapia Mozambique (TM) bio-dressing, Group III: PRP applied to wound bed + TM	PRP+TM significantly improved epidermal thickness, neovascularization, hair follicles, sebaceous and sweat glands, reduced collagen density, and broader and more even caspase-3 expression	Synergistic biologic therapy enhances graft integration and tissue remodeling, apoptosis (caspase-3) as a regulator of optimal healing	Small sample size, short observation period (21 days), no PRP-only group, lack of functional/clinical outcome measures

			bio-dressing			
Jasim et al. (2025)	Controlled experimental animal study	Rabbit avulsion skin wound model	Comparison of autogenic, allogenic, and heterogenic PRP treatments	PRP treatments accelerated wound healing, with autogenic PRP generally showing superior regenerative effects	PRP effectiveness may depend on biological source compatibility, autologous PRP appears most effective	Limited sample size, immunologic responses to heterogenic PRP require further investigation, and long-term tissue quality has not been fully evaluated
Pitafi (2024)	Experimental animal study	Rabbit cutaneous wound model	Combined application of Autologous PRP with a hydrofiber dressing	Faster wound contraction, improved epithelialization, and enhanced healing quality compared to conventional management	Combination therapy using PRP and advanced dressings may synergistically improve wound healing outcomes	Lack of molecular or histopathological mechanistic analysis, applicability to naturally occurring clinical wounds remains uncertain
Accorroni et al. (2025)	Narrative review	Veterinary perspective (different species)	Topical use of sucralfate for cutaneous wound management	Protects damaged mucosa/skin, stimulates angiogenesis, and accelerates tissue remodeling	Shift toward cost-effective, easily accessible topical barriers that also promote healing	Lacks standardized clinical trial protocols specifically comparing sucralfate directly to modern bioscaffolds in small animals
Dutra Alves et al. (2025)	Systematic review	General biomedical / skin models	Advanced regenerative medicine-based approaches for skin regeneration/rejuvenation	Successfully identifies pathways to accelerate re-epithelialization and reduce aesthetic scarring	Combining biomaterials with cellular signaling molecules yields the highest-quality dermal remodeling.	Translating highly controlled lab/biotech advancements into affordable, scalable veterinary clinical therapies remains slow
Soares et al. (2025)	Clinical case series / prospective clinical application study	Domestic animals presenting traumatic skin wounds and chronic ulcers (dogs and cats)	Topical application of autologous PRP gel directly onto traumatic wounds and chronic ulcers with repeated treatment sessions	Accelerated granulation tissue formation, faster wound contraction, improved epithelialization, and successful healing in chronic ulcerative lesions	PRP gel provided concentrated growth factors, including PDGF, TGF-β, VEGF, and EGF, that stimulated angiogenesis, fibroblast proliferation, extracellular matrix deposition, and epithelial regeneration	Limited sample heterogeneity, lack of a randomized control group, absence of standardized treatment intervals, and insufficient long-term comparative outcome analysis
Watanabe et al. (2025)	*In vitro* comparative experimental study	Cultured gingival epithelial cells	Comparison between Plasma Rich in Growth Factors (PRGF) and leukocyte-containing PRP on epithelial cell culture	Both plasma preparations promoted cell proliferation and wound closure; PRGF demonstrated a more favorable epithelial migration response, while leukocyte-rich PRP produced variable inflammatory effects	Growth factors stimulated epithelial proliferation and migration, whereas leukocyte content influenced inflammatory signaling pathways that may either enhance or delay tissue repair, depending on concentration	*In vitro* design limits clinical extrapolation, the absence of an animal or *in vivo* wound model, focuses only on gingival epithelial cells, and has an unclear optimal leukocyte concentration for therapeutic use

AG: Ionized silver, DDM: Decellularized dermal matrix, ECM: Extracellular matrix, EGF: Epidermal growth factor, GF: Growth factor, HGF: Hepatocyte growth factor, HUVECs: Human umbilical vein endothelial cells, IGF-1: Insulin-like growth factor 1, iMPs: Induced pluripotent stem cell-derived megakaryocytes and platelets, iPSC: Induced pluripotent stem cell, L-PRF: Leukocyte- and platelet-rich fibrin, PDGF: Platelet-derived growth factor, PPP: Platelet-poor plasma, PRF: Platelet-rich fibrin, PRGF: Plasma rich in growth factors, PRP: Platelet-rich plasma, PR-PRP: Protein-rich platelet-rich plasma, ROS: Reactive oxygen species, TGF-β: Transforming growth factor beta, VEGF: Vascular endothelial growth factor.

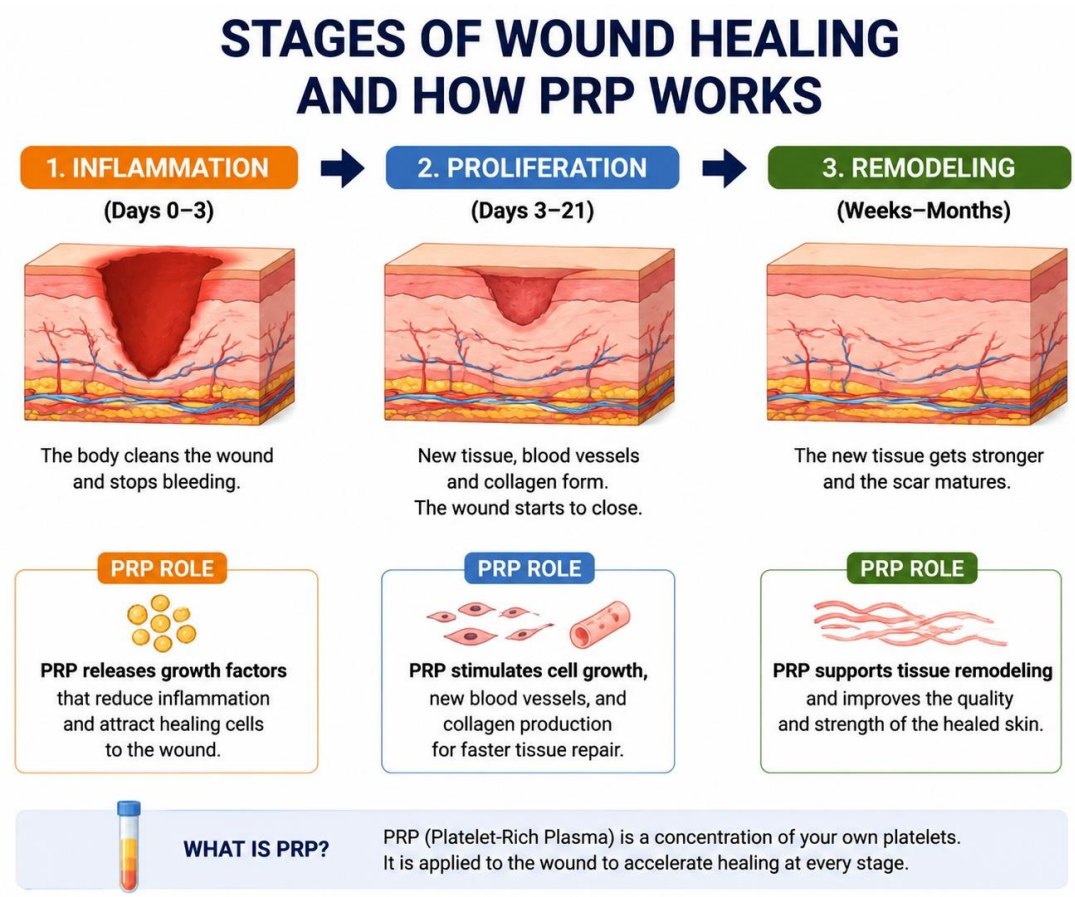

Figure 2. Stages of wound healing after using platelet-rich plasma treatment. Platelet-rich plasma is applied during the inflammatory stage to promote hemostasis and release growth factors, thereby supporting cell migration and angiogenesis in later stages. This figure was conceptualized and drafted by the authors. The initial layout was created using AI-assisted graphic tools, with all final annotations, scientific labeling, and structural integration performed manually by the authors to ensure accuracy.

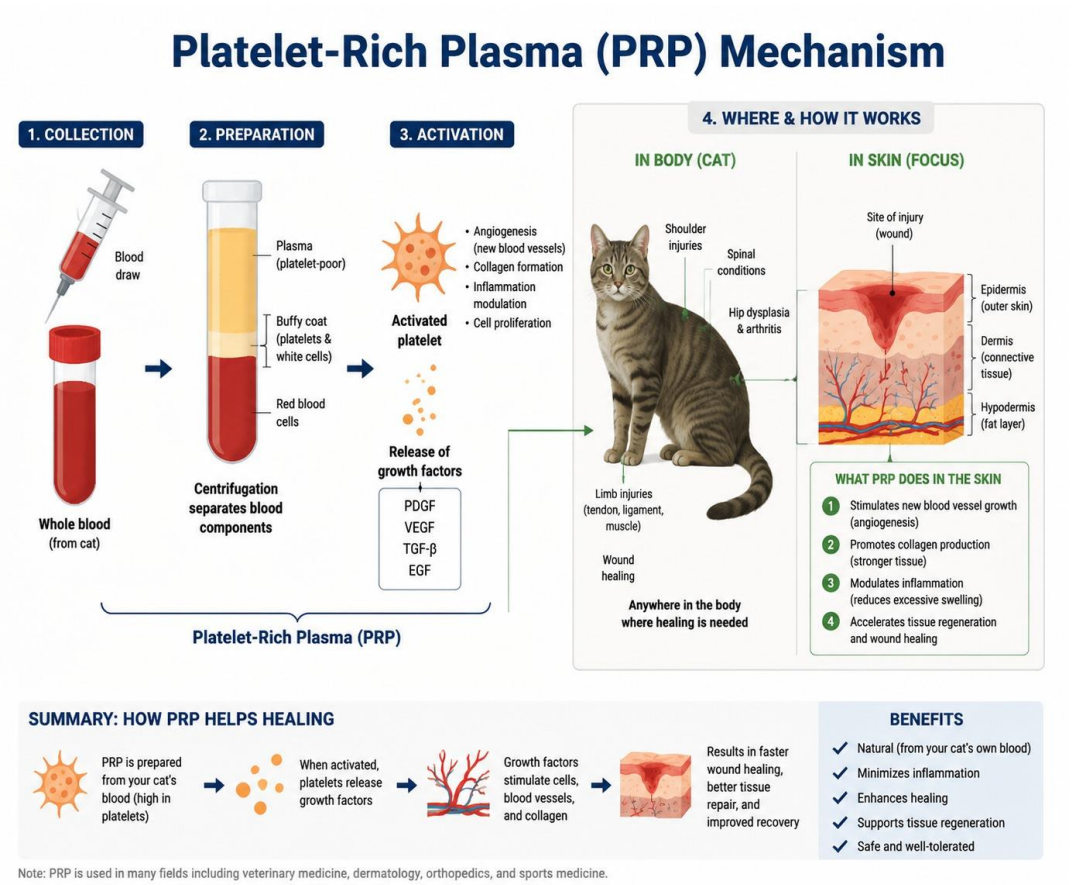

Figure 3. Platelet-rich plasma mechanism in skin wound healing in felines. Platelet-rich plasma releases growth factors that promote tissue regeneration, angiogenesis, and collagen synthesis. This figure was conceptualized and drafted by the authors. The initial layout was created using AI-assisted graphic tools, with all final annotations, scientific labeling, and structural integration performed manually by the authors to ensure accuracy.

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CHALLENGES AND STANDARDIZATION LIMITATIONS

Although there is broad agreement on the regenerative capabilities of platelet-derived products, studies have reported different outcomes. Aragosa et al. (2025) found that L-PRF facilitated complete wound re-epithelialization in chronic canine wounds. Additionally, Kosaka et al. (2024) reported promising findings with iMPs; however, their application remained confined to experimental settings, and their practicality and scalability in routine veterinary clinical practice remained uncertain. The primary challenge highlighted in several studies was the absence of established protocols for preparing PRP in animal studies. Variations in centrifugation procedures, leukocyte and platelet concentrations, and activation methods contribute to substantial inconsistencies in outcomes. The included veterinary studies differed in PRP/PRF preparation. In dogs, PRP was prepared by double centrifugation, yielding platelet concentrations of 1,050-1,550 × 10^3/µL (Iacopetti et al., 2020). In cats, PRF was prepared from 5 mL of blood by centrifugation at 400 g for 10 minutes (Zhang et al., 2024). In rabbits, PRP was prepared from 5-6 mL of blood using sequential centrifugation at 100 g and 400 g for 10 minutes (Jasim et al., 2025). These differences might account for inconsistent resulted across species and studies, complicating the replication of findings across trials and animal models (Zhang et al., 2024).

Veterinary applications

For veterinary medicine, wound treatment using PRP is particularly encouraging. The PRP offered a safe, autologous, and cost-effective solution for veterinary wound management, especially where prolonged healing or infection risk is a concern (Zhang et al., 2024; Wang et al., 2025a). These applications include the use of PRP to treat surgical incisions, traumatic skin wounds, pressure sores, and chronic non-healing ulcers (Zhang et al., 2024; Soares et al., 2025). These findings suggested that PRP could serve as a valuable adjunctive therapy to enhance wound healing in canines (Carr et al., 2024). Furthermore, Carr et al. (2024) examined the evidence for PRP in canine wound healing, highlighting its benefits in epithelialization, scar minimization, antimicrobial properties, and vascular ingrowth. However, most veterinary studies remain limited by small sample sizes, short follow-up periods, and a lack of long-term assessments of scar quality, tissue function, and potential adverse effects. The absence of standardized PRP preparation protocols across veterinary species represented a critical limitation. Species-specific differences in platelet biology, blood volume, and growth factor composition necessitate tailored centrifugation parameters, activation methods, and dosing regimens that are currently not established.

There is still no agreement on the optimal PRP formulation across species and wound types in veterinary animals. The long-term effects of PRP on tissue integrity, scar formation, and functional recovery in animals have yet to be thoroughly evaluated. The variability in preparation techniques underscored the need for established protocols to ensure consistent therapeutic efficacy. The absence of standardized preparation protocols and the inconsistent reporting of outcomes have restricted the widespread adoption of PRP in clinical practice.

CONCLUSION

The present study identified that PRP significantly accelerated wound closure, promoted neovascularization, and modulated pro-inflammatory cytokine expression in veterinary models, particularly in canines and felines. Studies in animal models have demonstrated PRP's therapeutic potential, although differences in preparation methods and outcomes have posed challenges to standardization. The present study integrated current evidence, highlighted the underlying mechanisms, and underscored the importance of further studies focused specifically on veterinary applications. Future research should emphasize standardizing protocols across different species, conducting large-scale randomized controlled trials in both companion and livestock animals, and investigating combined treatments that include PRP with biomaterials or negative-pressure wound therapy. Furthermore, continued investigation into combination therapies and advanced PRP formulations is essential to enhance the effectiveness and practical application of PRP in veterinary medicine.

DECLARATIONS

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Authors' contributions

Abellisa was responsible for the overall design and execution of the review, data collection, and analysis. Manuscript writing and ensuring all necessary revisions were made by Abellisa and Lestari Sukma Dinullah. Fikri Alsidik Ajis was instrumental in the conceptualization of the review, design, and editing of the manuscript. All authors have read and approved the final edition of the manuscript before publication in this journal.

Availability of data and materials

All data analyzed in this review are derived from previously published peer-reviewed articles. No new datasets were generated or analyzed during the current study. The datasets supporting the conclusions of this article are available within the cited literature.

Competing interests

The authors declared no conflict of interest.

Ethical considerations

The present study was originally written by the authors and has not been published elsewhere. The authors confirmed that Grammarly was used only for language editing, including grammar correction, sentence refinement, and clarity improvement. Regarding the figures, the authors affirmed that these figures were conceived and crafted to illustrate the specific research synthesis. Although Google Gemini was employed for preliminary layout and visual enhancement, all content, labels, annotations, and data presentation were meticulously curated, edited, and finalized by the authors to ensure scientific precision and alignment with the specific veterinary data. Authors have made manual revisions to ensure that the final output accurately reflects the distinct research framework and authentically depicts the PRP wound-healing stages. No AI tools were used for data analysis, interpretation, or the generation of scientific content. The authors take full responsibility for the manuscript's accuracy and integrity.

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