A review of Métis traditional medicines in wound care with a focus on white spruce (*Picea glauca*), yarrow (*Achillea millefolium*), and broadleaf plantain (*Plantago major*) in Canada

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Research

Abstract

Background: Skin injuries have been documented across the globe for centuries and are a common health concern worldwide. Although many methods have evolved to heal lacerations, traditional Métis medicines have remained underexplored in literature. This review aims to provide an overview of the common plants used by the Métis in wound care. Due to their consistent documentation across Métis oral histories and proximity to Métis homelands, white spruce (*Picea glauca*), yarrow (*Achillea millefolium*), and broadleaf plantain (*Plantago major*) offer insight into the applications of Métis medicines.

Methods: A narrative literature review was conducted using academic databases to identify primary and secondary sources on Métis traditional medicines and their wound care applications. Both ethnobotanical and biomedical studies were included to capture cultural and pharmacological perspectives.

Results: In *P. glauca*, the lignan 7-hydroxymatairesinol demonstrates anti-inflammatory properties that may support wound healing. *A. millefolium* contains natural antioxidants and linoleic acid that can reduce infection risk and help restore skin elasticity in later healing stages. *P. major* contains aucubin and allantoin, compounds associated with accelerated cellular regeneration. Studies suggest that integrating these traditional medicines into modern wound dressings may help reduce complications and improve healing outcomes.

Conclusion: This review highlights the therapeutic potential of Métis medicines in wound care. Future research should include collaboration with Métis knowledge holders and clinical studies to validate efficacy, determine safe dosages, and explore culturally respectful integration into modern biomedical practice.

Keywords: Wound care, Métis, traditional medicine, spruce, yarrow, plantain, Canada

Background

Skin is a multilayered organ that serves as a barrier from the external environment, protecting the body from dehydration and the penetration of microorganisms (Pereira & Bártolo 2016). A laceration refers to a traumatic skin injury (Quinn *et al*. 2014). Every year, these lesions affect millions of patients from all age groups and socioeconomic backgrounds (Baranoski *et al*. 2011). Wound healing is a complex process sensitive to alterations in the signaling cascade, which occurs in a series of overlapping steps known as hemostasis, inflammation, migration, fibroplasia, and maturation (Desai *et al*. 2024, Pereira & Bártolo 2016). Recovery from lacerations takes a few days to weeks, but a chronic wound may develop if disease processes interfere, leading to increased morbidity and delayed healing (Desai *et al*., 2024, Sivamani *et al*. 2012). Wound care involves assessing, cleansing, and dressing lacerations to facilitate healing and restore skin integrity. Goals include preventing infection, minimizing scar formation, and accelerating tissue repair (Baranoski *et al*. 2011, Desai *et al*. 2024). Properly dressing a dermatological wound is a critical component of wound care that maintains hydration, optimizes comfort, reduces inpatient stays, and supports faster healing (Pereira & Bártolo 2016). Over centuries of refinement, Indigenous Peoples in Canada have developed diverse plant-based remedies that represent highly effective approaches to wound care (Blouin 2003). Similar observations appear in early ethnobotanical documentation of Prairies and boreal communities, which record extensive use of conifer resins, yarrow, and plantain for wound care and infection control (Clavelle, 1997, Groulx 1954, Turner 2006, Turner 2018)

First Nations, Inuit, and Métis are officially recognized as Indigenous Peoples in Canada (Guimond *et al*. 2009). The Métis emerged from the intermarriage of Europeans and First Nations (Barkwell 2015, Supernant 2020). During their establishment, they adopted a semi-nomadic lifestyle and were engaged in hunting, trapping, traveling, and labor associated with the fur trade economy, leaving them vulnerable to dermatological injuries (Barkwell 2015, Sealey 1986). Métis families relied on each other to treat lacerations with remedies inspired by both European and First Nations practices (Edge & McCallum 2006, Johnston 1992). Significant overlap exists between the plants used among these groups, but the way in which these were prepared and purposed differed (Edge & McCallum 2006). Despite limited access to physicians, "…every (Métis) mother had her own stash of medicines used for croups, coughs, fevers and any number of childhood illnesses" (Campbell 2011 p. 1), including supplies of white spruce (*Picea glauca*), yarrow (*Achillea millefolium*), and broadleaf plantain (*Plantago major*) (Métis Nation of Ontario 2010, cf. Carpenter 1977) (Figure 1).

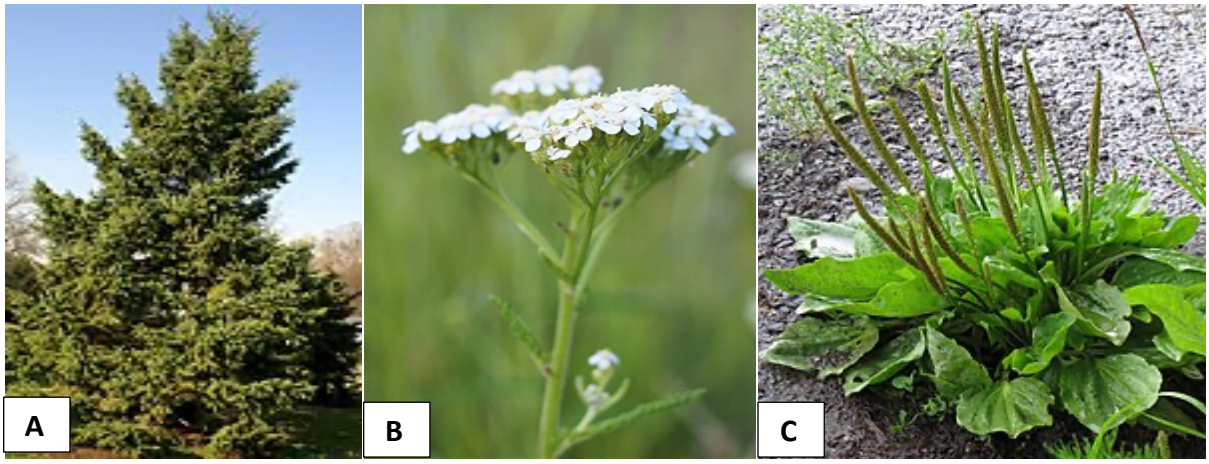

Figure 1. Images of A) white spruce (*P. glauca*; photo modified from Stang 2006); B) yarrow (*A. millefolium*; photo modified from Kwiecień 2020); C) broadleaf plantain (*P. major*; photo modified from Flogaus-Faust 2014).

The Métis homeland spans the northern Plains, Parkland, and southern Boreal regions of present-day Manitoba, Saskatchewan, Alberta, and parts of Ontario, North Dakota, and Montana (Kermoal & Altamirano-Jiménez 2016, Métis National Council 2019) (Figure 2). Due to the diversity in Métis practices spanning across diverse ecosystems, Métis plant knowledge reflects multiple environmental zones (Sealey 1986). The plants reviewed in this study were selected due to their wide accessibility across multiple Métis settlements in Canada (Barkwell 2018, Nilson *et al.* 2014, Paquin 2003, Sealey 1986). *P. glauca*, *A. millefolium*, and *P. major* are among the most consistently referenced in Métis ethnobotanical accounts (Barkwell 2018, Métis Nation of Ontario 2010, Nilson *et al.* 2014, Paquin 2003). They are mentioned frequently in oral histories, community reports, and regional ethnographies across Saskatchewan, Manitoba, Alberta, and Ontario (Barkwell 2018, Turner 2006, Vogel 2013). As well, each species has a documented bioactive compound with contemporary biomedical relevance, making them strong candidates for comparison with modern wound dressings.

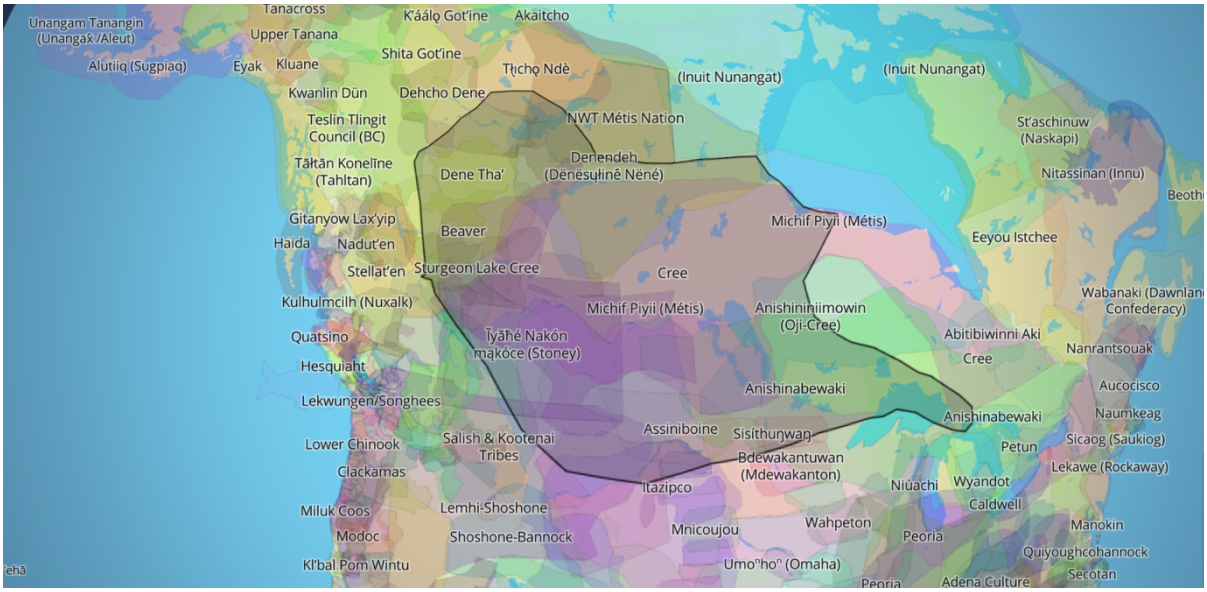

Figure 2. Map identifying the Métis homelands, superimposed with First Nations lands in Canada (modified from Native Land Digital 2023).

Despite a growing quantity of literature on traditional medicines, research specific to the Métis remains limited. Turner (2023) acknowledges the wide range of medicinal practices in Canada, but does not differentiate Métis practices from those of First Nations or Europeans. Furthermore, Métis healing methods have not yet been fully situated within the broader historical literature on wound care. For example, Haesler *et al*. (2016) reviews traditional medicines used in wound care, but does not explicitly reference Métis applications of these medicines. Together, these papers suggest an opportunity for further examination of the applications of Métis medicines in wound care, which this review begins to address.

While historical records have often overlooked Métis healing practices, evidence from historical, ethnobotanical, and biomedical literature suggests that Métis communities possessed effective wound care strategies, particularly in remote and resource-limited settings (Edge & Callum 2006, Kermoal & Altamirano-Jiménez 2016, Métis Nation of Ontario 2010). A Métis Elder supports this statement, as he recalls "…They never saw a doctor, not once. Even miscarriages, she gave them medicines, stuff like that…" (cited in Fryer *et al*. 2008 p. 43). Despite this rich traditional healing knowledge, the Métis are declining in their use of traditional remedies, emphasizing the importance of documenting successful applications of their medicine in the literature (Kermoal & Altamirano-Jiménez 2016, Johnston 1992).

The purpose of this review is to (1) demonstrate the historical and modern importance of Métis wound care; (2) detail the bioactive compounds of *P. glauca*, *A. millefolium*, and *P. major*; (3) compare similarities between traditional and modern wound care approaches; and (4) provide recommendations on the integration of both approaches. In ethnobotany, Métis traditional medicines present a relevant and unique synthesis of First Nations and European botanical knowledge (Kermoal & Altamirano-Jiménez 2016, Johnston 1992). Past studies on Indigenous medical systems have more broadly demonstrated the significant therapeutic efficacy of traditional healing, and have directly informed modern pharmacology and wound care development (Heinrich *et al*. 2018, Uprety *et al*. 2012). Therefore, understanding Métis-specific plant uses allows researchers to identify bioactive compounds, therapeutic mechanisms, and culturally grounded treatment practices that contribute to contemporary wound management strategies. For ethnobotany, Métis plant medicine is not simply another regional variant, but a historically distinct knowledge system shaped by mobility, trade, and intercultural exchange. Examining Métis wound care therefore contributes to scholarship on knowledge hybridity, adaptation, and plant relations under colonial conditions. By situating Métis traditional medicines within historical and biomedical contexts, this review underscores their continued relevance and potential to inform innovative, accessible, and culturally grounded wound care strategies.

Materials and Methods

A narrative literature review (Sukhera 2022) was conducted to analyze the historical development of Métis wound care and its parallels with modern approaches. An extensive search for primary and secondary sources was conducted using academic databases, including Google Scholar, PubMed, Elsevier, and ScienceDirect. Keywords included "Métis traditional medicine",

"plant-based wound dressings", "Métis wound care", alongside specific medicinal plants like "white spruce", "yarrow", and "broadleaf plantain". Sources were reviewed for relevance to Métis wound care practices. Literature focused on Indigenous wound care approaches predominantly detailing First Nations or broader ethnobotanical knowledge, without isolating Métis healing methods. Nevertheless, publications that specifically detailed Métis wound care practices were included. The sources consisted of peer-reviewed articles, scholarly books, and government or organizational reports. The last of these were from the Métis Nation of Ontario and Royal Canadian Geographical Society. Most articles utilized were published between 1990 and 2024, reflecting when most published Métis ethnobotanical work emerged. Nevertheless, articles published as early as the mid 19th century were included when they contained relevant primary historical information.

Results and Discussion

Métis traditional medicine

Between 1763 and 1830, the first independent Métis settlements emerged, forming a distinct identity from their European and First Nations ancestors through traditions, self-governance, language, and medicines (Fryer *et al*. 2008, Macdougall 2010, Métis Nation of Ontario 2010, Supernant 2020). Healing methods were often transmitted orally between generations of women in the family (Barkwell 2018, cf. Carpenter 1977). Through this intergenerational exchange of knowledge, healers applied medicinal practices inspired by both European and First Nations groups, reflecting a blend and integration of unique medical applications having been used far before the establishment of independent Métis settlements. Within their communities, they relied heavily on healers to treat common injuries, such as lacerations, as they had "…no drug stores and the general store had very little in the way of medicine. Even if they did, no one had the money to purchase them" (cited in Campbell 2011 p. 1).

In response to dermatological lesions, the Métis relied on poultices and teas of medicinal plants (Table 1) (Barkwell 2018). In northern Saskatchewan, they "…picked wild herbs and medicines, dried them, crushed others into powder and stored them all in cotton bags…" (cited in Campbell 2011 p. 1). A variety of preparations exists between Métis families, including boiling, baking, steeping, chewing, smoking, drying, shredding, as well as creating pastes, poultices, juices, decoctions, and infusions (Barkwell 2018, Blouin *et al*. 2003, Uprety *et al*. 2012). Leaves, buds, bark, roots, flowers, and cones were the most commonly used parts (Barkwell 2018). Medicines often consisted of food readily available around Métis settlements, though alternatives were used depending on regional or seasonal availability (Barkwell 2018, Royal Canadian Geographical Society 2018, cf. Turner 2018). Notably, Leclair (2003) emphasizes regional variation and ecological adaptation in Métis medicine, highlighting that ecological practices were deeply place-based and responsive to seasonal cycles. This supports the idea that plant choices, whether for medicine or food, was not arbitrary.

Table 1. Summary of white spruce, yarrow, and broadleaf plantain medicinal uses by the Métis in Canada

Common name	Scientific name	Parts used	Applications	Sources
White spruce	*Picea glauca* (Moench) Voss	Resin, bark, buds, shoots, needles	Cuts, rashes, burns, impetigo, sores, infection, sore throat, colds, laxative, teeth whitening	Barkwell 2018, Paquin 2003, Métis Nation of Ontario 2010, cf. Turner 2006
Yarrow	*Achillea millefolium* L.	Leaves, roots, flowers, seed	Infections, cuts, abscesses, burns, boils, rashes, fractures, bronchitis, coughs, nausea, stomach cramps, toothache, fever, nausea, vomiting, lactation	Saeidnia *et al*. 2011 cf. Nilson *et al*. 2014, cf. Turner 2006
Broadleaf plantain	*Plantago major* L.	Leaves	Cuts, sores, boils, burns, rashes, infections, eczema, psoriasis, bee stings, pink eye	Barkwell 2018, Métis Nation of Ontario 2010, cf. Nilson *et al*. 2014

The unique properties of the plants discussed in this review can be linked to the adaptations that enable them to survive in northern and prairie environments, which are subject to temperature fluctuations, short growing seasons, and other ecological stressors (Bourgeois *et al*. 2024). These conditions contribute to the production of biologically active compounds such as alkaloids and terpenoids (Arnason *et al*. 1981, Bourgeois *et al*. 2024). Although these compounds were not isolated until later in history, the Métis were aware of the health benefits these plants provided to treat symptoms (Blouin 2003, Groulx 1954, Vogel 2013).

White spruce (*Picea glauca*)

There are five species of spruce (*Picea* species) native to Canada, the only one of which that grows consistently across the country is *P. glauca* (Bourgeois *et al*. 2024, Turner 2006). Its wide distribution and diverse medicinal applications have made it a common resource among Indigenous groups (Barkwell 2018, Paquin 2003, Moerman 2003, Turner 2018, Vogel 2013). According to Paquin (2003), Métis in Saskatchewan chewed on hardened spruce gum or bark to treat constipation, colds, coughs, and influenza (Paquin, 2003, Turner 2006, cf. Vogel, 2013). Needles of *P. glauca* were also boiled to prepare a medicinal tea for lower respiratory tract infections (Paquin 2003, cf. Turner 2006). In Ontario, some Métis families chewed on the resin to whiten teeth (Métis Nation of Ontario 2010).

In wound care, *P. glauca* has been used to accelerate healing and prevent chronic wounds (Paquin 2003, Turner 2006, cf. Clavelle 1997). The aromatic pitch and gum were often processed into a medicinal salve for topical application to cuts, reducing infection risk (Moerman 2003, Turner 2006, cf. Clavelle 1997). Reports from Métis community members in Ontario describe its use as an antibiotic, although specific preparation details were not disclosed (Métis Nation of Ontario 2010). According to Paquin (2003), Métis in Saskatchewan softened spruce resin with grease over heat to treat impetigo, rashes, cuts, and burns. For infected wounds, a poultice was made by combining balsam poplar (*Populus balsamifera*) resin with *Picea* needles.

The therapeutic activity of *P. glauca* is largely attributed to 7-hydroxymatairesinol, a lignan with anti-inflammatory properties important in controlling inflammation during wound healing (Colantonio & Rivers 2017, Ferreira *et al*. 2017, Saarinen *et al*. 2000, Spilioti *et al*. 2013). In the inflammatory phase, chemokines and cytokines recruit macrophages and neutrophils to dilate nearby blood vessels, remove microorganisms, and prevent an infection (Desai *et al*. 2024, Pereira & Bártolo 2016). Research indicates that 7-hydroxymatairesinol, and its major isomer 7-hydroxymatairesinol 2, reduce vascular cell adhesion molecule-1, interleukin-6, and nitric oxide synthase, cellular messengers that promote vasoconstriction (Spilioti *et al*. 2013, Yang *et al*. 2017). Evidence also suggests that this compound suppresses tumor necrosis factor-α (TNF-α) mediated activation of nuclear factor-κB (NF-κB), thereby attenuating inflammatory responses in endothelial cells. Aqueous applications of 7-hydroxymatairesinol have shown success in lowering lipopolysaccharide-induced cellular oxidative stress (Ferreira *et al*. 2017). This further suggests its ability to enhance wound healing outcomes through its anti-inflammatory properties. Many of the systemic benefits of 7-hydroxymatairesinol reported in the literature result from its gut microbiome-mediated conversion to enterolactone (Saarinen *et al*. 2000), which has been associated with anti-inflammatory and antioxidant effects. While oral ingestion may involve downstream metabolism, the topical effects and dose-relevant wound healing outcomes require further direct study.

Yarrow (*Achillea millefolium*)

Achillea millefolium is one of the most widely used medicinal plants in the world, including among most Indigenous Peoples in Canada (Turner 2006, Turner 2018, Vogel 2013). It is widely distributed across Canada and has developed adaptations to the harsh climate. Therefore, Indigenous groups prepared the leaves and roots as teas or poultices to remedy bee stings, swelling, and vomiting (Turner 2018, Clavelle 1997). Among the Métis, its medicinal applications range from gastrointestinal complaints to respiratory infections (Métis Nation of Ontario 2010, Nilson *et al*. 2014, cf. Turner 2006, cf. Vogel 2013). In Saskatchewan, Métis families chewed the leaves to alleviate colds and support the immune system (Nilson *et al*. 2014, cf. Clavelle 1997, cf. Moerman 2003, cf. Turner 2006). In Ontario, Métis families use the aromatic compounds of *A. millefolium* to repel insects and alleviate pruritus associated with bites (Métis Nation of Ontario 2010, Turner 2006).

Traditional wound care applications of *A. millefolium* are widespread across Métis communities (Métis Nation of Ontario 2010, cf. Turner 2018, cf. Vogel 2013). Oral accounts from Métis author Maria Campbell (2011 p. 1) recalls that during the 1950s in northern Saskatchewan, her "…drug store was half a mile up the road… where yarrow, plantain, wild roses, fireweed, asters, nettles, and pigweed could be found in great abundance." In southern Ontario, Métis healers described the mild anesthetic and anti-inflammatory properties of *A. millefolium*, which were used to recover from skin infections and promote tissue repair (Métis Nation of Ontario 2010, Nilson *et al*. 2014). Across Indigenous groups, poultices prepared from its leaves

and roots have been applied to sores, abscesses, burns, rashes, spider bites, eczema, and fractures (Turner 2006, Vogel 2013).

The principal bioactive compounds of *A. millefolium* include sterols (e.g. β-sitosterol) and triterpenes (e.g. α-amyrin) (Chandler *et al*. 1982). However, most of its medicinal effects are attributed to secondary metabolites such as flavonoids, phenolic acids, and coumarins (Saeidnia *et al*. 2011). These compounds exhibit antioxidant activity, suggesting potential applications in the treatment of dermatological wounds (Konyalioglu & Karamenderes 2005). Antioxidants are important in scavenging reactive oxygen species (ROS), which at high concentrations can induce cellular damage and exacerbate inflammation (Poljsak *et al*. 2013, Pizzino *et al*. 2017). Moreover, the seeds of *A. millefolium* are rich in linoleic acid (ω-6), an essential polyunsaturated fatty acid (Silva *et al*. 2018). Studies suggest that ω-6 may also support the later stages of healing, including migration, fibroplasia, and maturation (Desai *et al*. 2024, Pereira & Bártolo 2016). During these phases, collagen is secreted into the dermis, organized into bundles, cross-linked, attached to proteins in the interstitial space, and repigmented, which aids in scab removal and restoration of skin elasticity (Declair 1997, Desai *et al*. 2024, Pereira & Bártolo 2016). Additionally, a study by Pereira *et al*. (2008) demonstrated the wound healing capacities of ω-6 when applied to a dermatological wound in rats. A topical administration of ω-6 increased wound healing tissue mass, without affecting vascular permeability (Pereira *et al*. 2008). These results suggest that *A. millefolium* may be applied as a natural agent for accelerating wound closure and effective tissue repair.

Broadleaf Plantain (*Plantago major*)

Following European colonization, *P. major* was introduced into Canada and quickly became widely available as a medicine and nutrient-rich food source (Barkwell 2018, Moerman 2003). Métis adoption of *P. major* was inspired by Europeans, and reflects the broader pattern of adaptive medical knowledge that was passed down through generations (Campbell 2011, Hawthorn 1974). In Ontario, Métis families used *P. major* to treat skin rashes, eczema, diarrhea, and psoriasis (Métis Nation of Ontario 2010). Among Indigenous groups, it was used to treat coughs and constipation, and its leaves were prepared as poultices applied to burns and snakebites (Clavelle 1997, Moerman 2003, Vogel 2013).

In wound care, *P. major* served as a first-line remedy among Métis families (Nilson *et al*. 2014). Across the Prairie provinces, the Métis applied it to cuts, sores, stings, and boils (Barkwell 2018, cf. Turner 2018). According to records from the Gabriel Dumont Institute, *P. major* was applied topically as a poultice to treat skin infections and accelerate healing (Paquin 2003, cf. Turner 2018). Alternatively, an Elder from Saskatchewan described chewing the leaves and applying them directly to injured skin to promote recovery (Nilson *et al*. 2014).

The principal active compounds of *P. major* are aucubin (an iridoid glycoside) and allantoin (Barkwell 2018). Aucubin exhibits both antimicrobial and antioxidant properties, protecting tissues from infections and ROS-induced damage, respectively (Barkwell 2018, Rahamouz-Haghighi 2023, Pizzino *et al*. 2017, Poljsak *et al*. 2013, Zeng *et al*. 2020). In addition to direct effects, aucubin also enhances endogenous antioxidant systems such as superoxide dismutase, catalase, and glutathione peroxidase (Zeng *et al*. 2020). It has been shown to inhibit NF-κB in masts cells, suppressing inflammation and promoting wound tissue healing (Rahamouz-Haghighi 2023). Collectively, these mechanisms may mitigate endothelium dysfunction during healing (Rahamouz-Haghighi 2023, Zeng *et al*. 2020). Allantoin is primarily recognized for its anti-inflammatory effects, stimulating cellular growth and tissue regeneration by reducing nitric oxide levels and oxygen production in human umbilical vein endothelial cells (Barkwell 2018, Lee *et al*. 2018). This may reduce inflammation and decrease the substrates available for ROS generation, promoting cellular regeneration. A study by Miere *et al*. (2021) describes its ability to stimulate fibroblasts migration, and when combined with pectin, allantoin hydrogel applications reduce total healing time by approximately 25% (Valle *et al.* 2020)

Parallels between traditional and modern wound care

Métis families have both historically and contemporarily used medicinal plants to assist in wound care, as demonstrated by the various applications of *P. glauca*, *A. millefolium*, and *P. major* (Métis Nation of Ontario 2010, Nilson *et al*. 2014, cf. Turner 2006). Similarly, modern wound dressings aim to facilitate the healing process, while minimizing infection and scarring (Ousey *et al*. 2023). Approaches include biological, advanced, bioactive, antimicrobial, or plant-based dressings, as well as advanced techniques such as skin grafts, bioengineered skins, and cell or growth factor therapies. Contemporary dressings often have high absorptive capacities, which allow for early mobilization and reduce the complications of blisters and skin tears. Even with these advancements, phytomedicines remain an important component of wound care, with over 50% of synthetic drugs derived from bioactive plants compounds (Piochon *et al*. 2023, Bourgeois *et al*. 2024). Of these, approximately 74% retain the same use as indicated by traditional healers (Obomsawin 2007). As phytomedicines are

sustainable, cheap, locally accessible, integrating traditional medicines with modern dressings may provide an effective strategy for achieving faster healing with minimal infection.

A study guided by a Saskatchewan Elder investigated the antimicrobial properties of *A. millefolium* and *P. major* against *Pseudomonas aeruginosa* and *Staphylococcus aureus*, common bacteria found in dermatological wounds (Nilson *et al*. 2014). Both plants demonstrated greater efficacy against *S. aureus*, attributed to the presence of alkaloids and saponins in these species. These compounds may accelerate healing by raising the number of neutrophils that aid in eliminating harmful microorganisms at the site of injury. As well, the antioxidant properties of *P. major* appeared to reduce tissue damage and support dermatological tissue repair. These findings reinforce the potential integration of traditional medicinal compounds into modern wound dressings to enhance healing outcomes.

Recent studies have explored combining plant-based compounds with biocompatible dressings. For instance, incorporating *P. glauca* resin or *A. millefolium* into nanofiber coverings has shown improved tensile strength and elasticity, while maintaining antimicrobial activity against *S. aureus* (Radisavljevic *et al*. 2023). This suggests that utilizing these dressings in wound care may promote earlier patient mobilization, optimize wound healing, and decrease infection risks. Moving beyond the plants discussed in this review, research has also investigated curcumin incorporated into collagen films (CICM) (Gopinath *et al*. 2004). In an *in vivo* study of rats, CICM dressings demonstrated greater wound reduction, enhanced cell proliferation, and improved free radical scavenging compared to collagen alone. These results imply that the integration of bioactive phytochemicals into modern dressings can synergistically enhance healing processes, offering a promising strategy for advanced wound care in the future.

Limitations

While this review has highlighted important connections between Métis and modern wound care, there are several limitations to the information gathered for this purpose. It is acknowledged that healing methods are passed down orally, and by not including first-hand accounts from Métis knowledge holders, certain practices not included in literature may have been overlooked (Fryer *et al*. 2008). Furthermore, healing methods can vary significantly between Métis families and communities, meaning that differences in wound care practices may not be adequately represented in the available sources. Despite the broad homelands of the Métis, sources of ethnobotanical research from each region are uneven and may be biased to some particular regions of Canada, such as Saskatchewan and Ontario. Regions inhabited by the Métis in regions like Manitoba, are therefore underrepresented in the literature used for this particular study. As traditional medicine is deeply embedded within language, landscape, and lived experience, future research should consider collaborative methodologies that involve Métis communities directly, to collect information across a variety of geographical areas.

Although many of the medicinal plants discussed in this literature review demonstrate potential efficacy in wound healing, additional empirical evidence from clinical trials is needed to determine dosage, identify bioactive compounds, and assess potential adverse reactions (Uprety *et al*. 2012). This is particularly important when considering contraindications, both between traditional medicines and in combination with western treatments. Concentrating bioactive ingredients and their secondary metabolites may also affect patient safety and outcomes, as these can trigger allergic sensitivities or cause irritation (Bourgeois *et al*. 2024, Sivamani *et al*. 2012, Uprety *et al*. 2012). Clinical trials are essential to evaluate safety profiles and establish appropriate therapeutic doses, especially for the plants like *Picea glauca*, which still have not yet rigorously evaluated in this setting (Sivamani *et al*. 2012). Overall, applications of traditional medicines must be further studied within controlled and ethical frameworks, before becoming broadly recommended or commercialized.

Finally, this literature review did not address the spiritual or ceremonial aspects of Métis healing, the process of gathering plants, or how information is orally transmitted. While some sources used in this study noted these aspects of traditional medicine, this paper has focused on the biomedical relevance of certain medicinal plants used by the Métis for wound care. Therefore, this article has not explored the holistic worldview that traditionally accompanied Métis health practices. Future work should strive for more culturally comprehensive frameworks that recognize both physical and spiritual dimensions of healing.

Conclusion

This literature review has examined the traditional healing practices of the Métis in Canada, with a focus on the applications of white spruce (*Picea glauca*), yarrow (*Achillea millefolium*), and broadleaf plantain (*Plantago major*) in wound care. These plants are abundant throughout Métis settlements, ensuring accessibility to adaptogenic plants with medicinal properties.

They are cultivated and prepared in various ways, based on regional preference and intended therapeutic use. Recent studies have identified key bioactive compounds relevant to dermatological wound healing, including 7-hydroxymatairesinol in *P. glauca*, linoleic acid in *A. millefolium*, as well as aucubin and allantoin in *P. major*. Evidence suggests that these compounds may accelerate wound healing and reduce infection risk. Advances in wound care have begun incorporating bioactive compounds from traditional medicines into dressings to optimize therapeutic outcomes. Findings synthesized in this literature review have highlighted the key traditional medicines in Métis wound care. Future research should prioritize clinical validation, dosage standardization, and the development of integrative wound care therapies that ethically combine traditional knowledge with modern biomedical approaches.

Declarations

List of abbreviations: AB- Alberta; BC- British Columbia; CICM- Curcumin incorporated into collagen films; MB- Manitoba; NB- New Brunswick; NF-κB- Nuclear factor-κB; NL- Newfoundland and Labrador; NS- Nova Scotia; NT- Northwest Territories; NU- Nunavut; PE- Prince Edward Island; QC- Quebec; ROS- Reactive oxygen species; SK- Saskatchewan; YT- Yukon
Ethics statement: Not applicable
Consent for publication: Not applicable
Availability of data and materials: Not applicable
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