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A Review of Wound Healing Potential of *Soodan* (Camphor) and Its Integration in Siddha Medicine

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ABSTRACT

Soodan (Camphor), derived from *Cinnamomum camphora*, exhibits significant potential as a wound healing agent due to its diverse pharmacological actions, including antibacterial, antifungal, analgesic, anti-inflammatory, antioxidative, antipruritic, and counterirritant effects. These therapeutic properties are attributed to its rich phytochemical composition, particularly monoterpenes, sesquiterpenes, and borneol. Siddha philosophy emphasizes its role in balancing tridoshas (vatham, pitham and kapham), a key factor in promoting healing.

Animal studies highlight *Soodan*'s efficacy in accelerating wound closure. In a Wistar rat model, 10% *Soodan* ointment significantly reduced wound size compared to controls, with highly significant outcomes by Day 14 ($p<0.000$). Camphor's antibacterial properties were demonstrated by its inhibitory effects on pathogens such as Staphylococcus aureus and Escherichia coli. Its anti-inflammatory effects include reducing cytokine levels like IL-1β and TNF-α. Additionally, its antioxidative action is supported by flavonoid-rich extracts that effectively neutralize free radicals.

Soodan's pharmacokinetics reveal rapid absorption and hepatic metabolism, though its ability to cross the placenta necessitates caution during pregnancy and lactation. While traditional Siddha texts align with modern evidence, further research is needed to explore its full therapeutic potential and optimize safe, effective clinical applications. *Soodan* integrates

Siddha principles with modern pharmacology, demonstrating remarkable promise as a wound-healing agent due to its multi-faceted therapeutic properties and clinical efficacy in accelerating healing.

Keywords: Anti-bacterial, Anti-inflammatory, chemical components of Camphor, Wound healing

INTRODUCTION

Wounds are a major global health concern, particularly in developing nations, where they contribute significantly to morbidity and permanent impairment. The growing challenges of drug resistance, allergies to synthetic pharmaceuticals, and limited access to affordable medications highlight the urgent need for alternative treatments. In Sri Lanka, the economic crisis has further restricted the availability of cost-effective wound care solutions (World Health Organization, 2008; Amini, et al., 2015).

Soodan (Camphor), derived from *Cinnamomum camphora*, is widely known in Sri Lanka for its use in traditional medicines and religious practices. Siddha Tamil literature emphasizes the therapeutic value of *Soodan*, particularly in wound healing, as noted in the following stanza:

"*Kirumisala thodang kilaivalippu sanni*
*porumu mantham angipatta **pun**nodu eru surangal*
vanthi pitham seethamuru vatham sevi muga noi
kanthi karupporamendrat saatru" (Thiyagarajan, 2009).

According to Siddha philosophy, diseases arise from imbalances in tridoshas (vatham, pitham, and kapham). *Soodan* is believed to balance these doshas, promoting healing by addressing the root cause. While traditional texts detail its use for wound care, scientific validation of these claims is necessary to ensure safety and efficacy (Vajiravelu, et al., 2019).

Despite its accessibility and potential therapeutic benefits, gaps in the literature exist regarding *Soodan*'s pharmacological mechanisms, clinical efficacy, and safety. This review aims to address these gaps by systematically analyzing *Soodan*'s wound-healing properties, integrating Siddha philosophy with contemporary scientific evidence to explore its potential as a viable alternative in wound care (Chambliss, 2010).

The hypothesis under review is whether *Soodan* (Camphor) effectively promotes healing of wounds. The overarching objective of this review is to assess the wound healing capabilities of *Soodan* (Camphor) by systematically evaluating existing literature and experimental data.

Specifically, the aims of this review are to identify and explore the chemical components of *Soodan*, focusing on their specific roles in promoting wound healing. This involves analyzing the known phytochemical profile of camphor, particularly compounds like camphor, borneol, and monoterpenes, which are implicated in its therapeutic effects. Additionally, the review will examine the pharmacological actions of these chemical components in the context of wound healing, such as their antimicrobial, anti-inflammatory, and antioxidative properties, and their mechanisms in promoting tissue repair and reducing infection. Finally, the review will evaluate the wound healing potential of *Soodan* by analyzing evidence from previous research, including in vitro, in vivo, and clinical studies. This will include assessing data on the efficacy of *Soodan* in accelerating wound closure, its impact on wound size reduction, and its safety profile. Through this comprehensive approach, the review will provide a well-rounded understanding of *Soodan*'s therapeutic benefits and limitations, contributing valuable insights into its clinical potential as a therapeutic agent for wound healing, grounded in both traditional Siddha knowledge and modern scientific evidence.

MATERIALS AND METHODS

This systematic review, guided by PRISMA guidelines, explores the wound healing properties of camphor through a rigorous and structured methodology. A comprehensive search strategy was employed using databases like PubMed, Scopus, and Web of Science, with keywords such as camphor, *Soodan*, wound healing, antimicrobial, and anti-inflammatory. Boolean operators refined the search results to ensure relevance. The review included studies published in English peer-reviewed journals that provided original data on camphor's wound healing potential, excluding those with insufficient methodological details, non-English publications, and reviews without original research. Data on study type, sample size, intervention, outcomes, and key findings were systematically extracted. To ensure quality, the Cochrane Risk of Bias tool was used to assess the methodological rigor of the included studies. Complementing this modern research, the review also incorporated insights from Siddha texts such as *Gunapadam Thathujeeva Vakuppu, Siddha Mooligai Thiravukol*, and *Siddha Maruthuvam Sirappu*. Information from indexed journals, microbiology references, dissertations, and online resources enriched the analysis, providing a holistic perspective that bridges traditional knowledge and contemporary scientific evidence.

RESULTS AND DISCUSSION

Gunapadam Aspect of *Soodan* (Camphor)

Botanical Name: *Cinnamomum camphora*

Family Name: *Lauraceae*

Vernacular name

Tamil name – *Soodan*

English name- Camphor

Sinhala name- *kapuru*

Other names – *karupooram, sudarkodiyon, pooram, theepam* (Nadkarni, 2010).

Organoleptic character

Suwai – Bitter and Pungent

Veeriyam - Hot

Vibakam – Pungent (Thiyagarajan, 2009).

General character of *Soodan*

"kirumisala thodang kilaivalippu sanni
*porumu mantham **angi patta punno**-derisurangal*
vanthipitham seethamuru vathanch sevimuga noi
kanthikarup pooramendrat sattru"

(Thiyagarajan, 2009).

According to above stanza *Soodan* is beneficial in wound healing. Wound is referred as *angi patta punn* in above stanza. *Soodan* mixed with *pattai sarayam* (alcohol) and brandy, which is used for *padukkai viranam* (bed sores) (Thiyagarajan, 2009).

"Podiththan kadhiron thirai nettrip
pugal mup pala neerp palingalai ingu
kaddipoo maalai yavaranthagi
kamal thamaraiththan kazh iyinan"

(Chinthamani – 2356)

Above stanza explained that soaked water of *kadukai, Thandrikkai* and *nellikai*; which mixed with *soodan* powder use to wash wounds externally (Thiyagarajan, 2009). According to siddha *sirappu maruthuvam; katpoora thailum* (Camphor oil) can be used for *koppulam* (blister) externally (Thiyagarajan, 1995).

Phytochemical Aspect

Soodan (Camphor) is derived from *Cinnamomum camphora* trees through distillation process. sometime which can be produce artificially from vicryl chloride and cyclopentadines (Guo, et al., 2016).

Chemical Composition

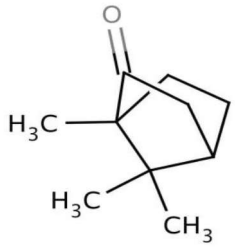

Figure 01- Structural formula of Camphor, a bicyclic monoterpene ketone

Pragadheesh et al. reported that extracts from *Cinnamomum camphora* leaves are rich in various compounds including camphor and monoterpenes, known for their antibacterial and antifungal properties. Additionally, they contain sesquiterpenes with antimicrobial and antioxidant effects, oxyterpenes with antioxidant properties, borneol with anti-inflammatory effects, 1,8-cineole also known for its anti-inflammatory properties, and α-terpineol acting as a counter irritant (Pragadheesh, et al., 2017).

The essential oil extracted from the bark comprises D-camphor, 3-methyl-2-butenoic acid (a fatty acid), and oct-3-en-2-yl ester, which exhibits antimicrobial properties. Furthermore, it contains γ-terpinene and isoterpinolene, known for their anti-inflammatory and antioxidant effects. Additionally, it includes 1,3,8-p-menthatriene, terpinen-4-ol, α-terpineol, eugenol, β-cadinene, and α-cubebene, all possessing anti-cancer properties (Tuntarawongsa & Phaechamud, 2012).

Pharmacological Actions

Text book of Gunapadam (*Dhathu Jeeva Vaguppu*) mentioned that *soodan* has stimulant, carminative, sedative, anodyne, antispasmodic, antiseptic, hypnotic, expectorant and aphrodisiac actions (Thiyagarajan, 2009). *Soodan* (Camphor) has pharmacological action of antimicrobial, counterirritant, anodyne, antipruritic, local anesthetic and rubefacient (Hercogov, 2005). For the wound healing; antibacterial, anti-inflammatory, antifungal, analgesic, antioxidative, antipruritic and counterirritant activities are very important (Salman, et al., 2012).

The previous animal study evaluating the wound healing efficacy of *Soodan* (Camphor) involved six groups of Wistar albino rats, each comprising six animals. Groups included untreated control, emulsifying ointment base, Neosporin powder, 10% Neosporin ointment, purified *Soodan* powder, and 10% purified *Soodan* ointment. Wound circumference measurements started with uniform sizes of approximately 120 mm² on Day 0. By Day 14, the 10% purified *Soodan* ointment group demonstrated the most significant reduction in wound size, with mean circumferences of 1–3 mm². Statistical analysis using ANOVA indicated significant differences in wound healing by Day 10 ($p=0.042$), with highly significant outcomes by Day 14 ($p=0.000$). Post Hoc Tukey tests confirmed that 10% *Soodan* ointment showed superior efficacy compared to untreated groups ($p=0.003$) and was statistically better than 5% *Soodan* ointment ($p=0.049$). The unit healing time was 0.0749 days/cm² for 10% *Soodan* ointment, significantly outperforming purified *Soodan* powder at 0.1176 days/cm² ($p=0.001$). Overall, the study highlighted the superior wound healing properties of 10% purified *Soodan* ointment, attributed to its enhanced penetration and retention due to the ointment base. The findings emphasize the potential for *Soodan* formulations in wound care, with concentrations below 11% deemed safe and effective (Thanushiyan, et al., 2024).

Antibacterial Activities

Chen et al.'s study investigates the antimicrobial potential of essential oils extracted from *Cinnamomum camphora* leaves and wood. The leaf oil demonstrated significant activity against various bacteria, including *Staphylococcus aureus, Enterococcus faecalis, Bacillus subtilis, Salmonella enterica gallinarum*, and *Escherichia coli*, with minimum inhibitory concentrations (MICs) ranging from 0.8 to 8.0 μg/mL (Moglad, et al., 2020). Notably, the wood oil exhibited notable antibacterial efficacy against Serratia marcescens. The study highlights the role of major components such as camphor, 1,8-cineole, α-terpineol, and safrole in contributing to the antimicrobial activity of the oils. Additionally, synergistic interactions between 1,8-cineole and camphor were suggested to enhance their antibacterial effects (Liu, et al., 2002). The research methodology involved antibacterial screening using tryptic soy agar medium and dilutions of essential oils in CAMHB, with microorganisms sourced from the American Type Culture Collection (ATCC) (Singh & Jawaid, 2012).

Table 01: Zone of inhibition using Standard Cultures

S. No.	Name of Organism	Camphor
1	*Escherichia coli* (ATCC 25922)	6 mm
2	*Escherichia coli* (ATCC 35218)	-ve
3	*Staphylococcus aureus* (ATCC 13565)	15 mm
4	*Staphylococcus aureus* (ATCC 25923)	-ve
5	*Pseudomonas aeruginosa* (ATCC 10145)	5 mm
6	*Pseudomonas aeruginosa* (ATCC 27853)	-ve
7	*Pseudomonas aeruginosa* (ATCC 15442)	-ve
8	*Salmonella typhi* (ATCC 19430)	-ve
9	*Bacillus subtilis* (ATCC 19659)	10 mm
10	*Bacillus subtilis* (ATCC 6033)	9 mm

Camphor showed antimicrobial activity against Staphylococcus aureus (15 mm), Escherichia coli (6 mm), Pseudomonas aeruginosa (5 mm), and Bacillus subtilis (9-10 mm). No activity was observed against other tested strains (Chen, et al., 2020).

Furthermore, the study elucidates the inhibitory effects of cinnamomin on solid melanoma growth in mice and the mechanism of action of D-camphor in hindering oxidative metabolism in E. coli. The findings suggest potential applications of ribosome-inactivating proteins (RIPs) in drug development and crop plant technology (Wang, et al., 2020).

Overall, the research underscores the diverse antimicrobial activities of *C. camphora* essential oils against a range of pathogens, both Gram-positive and Gram-negative (Viljoen, et al., 2003). It provides valuable insights into the bioactive components responsible for these effects and highlights potential synergistic interactions among them. The study's experimental design and methodology contribute to the understanding of the antimicrobial properties of *C. camphora* essential oils and their potential therapeutic applications (DeCarlo, et al., 2020).

Anti-inflammatory Activity

Cinnamomum camphora, when topically applied with 5% croton oil, shows dose-dependent effects on mouse ear edema: 110 to 220 mg/kg doses reduce edema, but 400 mg/kg increases it, an oily blend with *C. camphora*, Menthol, and Thymol exhibits potent anti-inflammatory effects in rats. Traditional use of camphor (*Soodan*) for inflammatory conditions is supported by its recognized anti-inflammatory and antioxidative properties, validated by in vitro studies on *C. camphora* leaf extract (Ghori, et al., 2016).

The study found that Borneol Essential Oil (BEO) exhibited strong human erythrocyte membrane stabilization, inhibiting both heat-induced and hypotonic solution-induced hemolysis with IC50 values of 5.29 mg/mL and 0.26 mg/mL, respectively. Topical application to mice auricles significantly reduced xylene-induced auricle swelling ($p < 0.0001$) and downregulated inflammatory mediators like IL-1β, IL-6, and TNF-α in both serum and tissue ($p < 0.05$ to $p < 0.001$). GC-MS analysis identified 43 components, with borneol being the most abundant (20.9%), followed by β-caryophyllene, camphor, and limonene. The skin permeability of BEO was evaluated, with BEO and its nano-emulsion showing steady-state transdermal diffusion rates of 6.7 mg/cm²·h and 8.9 mg/cm²·h, respectively (Lee, et al., 2016).

Antifungal Activity

A concentration of 5000 ppm of *Cinnamomum camphora* oil inhibited Aspergillus flavus growth, with complete inhibition at 4000 ppm, demonstrating fungistatic properties. Ho Chen-Lung et al. found antifungal activity in essential oils from *C. camphora* leaves, flowers, and twigs, with the leaf oil showing the highest potency (Mishra, et al., 2018). Antifungal screening involved culturing fungi on yeast-nitrogen base medium, with essential oil dilutions prepared in DMSO. Fresh fungi were added to microdilution plates and incubated, with DMSO and amphotericin B as negative and positive controls, respectively (Elfadil, et al., 2015).

Table 2: The inhibition of camphor in vivo against different species of *Fusarium*.

Camphor Contents (mg/mL)	*F. oxysporum* G5 **(%)**	*F. solani* G9 **(%)**	*F. verticillioide* **(%)**	*F. graminearum* **(%)**
0.125	3.80 ± 1.43 a	14.55 ± 4.70 a	9.36 ± 1.34 a	7.37 ± 4.78 a
0.25	11.18 ± 1.22 ab	13.60 ± 2.53 a	15.88 ± 2.29 b	33.46 ± 7.80 b
0.50	23.61 ± 4.72 b	15.64 ± 0.52 a	23.99 ± 1.78 c	45.79 ± 3.95 b
1.00	54.63 ± 9.76 c	34.59 ± 4.98 b	54.36 ± 1.34 d	89.41 ± 5.17 c
2.00	83.65 ± 2.37 d	91.98 ± 3.51 c	82.61 ± 3.29 e	95.84 ± 0.13 c
4.00	100.00 e	100.00 c	94.60 ± 0.11 f	100.00 c

Camphor demonstrated a dose-dependent inhibitory effect against various *Fusarium* species. At the lowest concentration (0.125 mg/mL), inhibition rates were minimal, ranging from 3.80% to 14.55%. As the concentration increased to 0.25 mg/mL, there was a noticeable increase in inhibition, especially for *F. graminearum*, which reached 33.46%. At 0.50 mg/mL, inhibition further increased, with *F. oxysporum* and *F. verticillioide* showing significant inhibition (23.61% and 23.99%, respectively). At 1.00 mg/mL, inhibition rates rose substantially for all species, with *F. graminearum* exhibiting the highest inhibition (89.41%). At 2.00 mg/mL,

camphor achieved near-complete inhibition of *F. oxysporum* (83.65%) and *F. graminearum* (95.84%), while *F. solani* (91.98%) and *F. verticillioide* (82.61%) also showed high inhibition. By the highest concentration tested (4.00 mg/mL), camphor completely inhibited *F. oxysporum*, *F. solani*, and *F. graminearum*, and nearly completely inhibited *F. verticillioide* (94.60%). These results indicate that camphor exhibits strong antifungal activity, especially against *F. oxysporum* and *F. graminearum*, with its effectiveness increasing as the concentration is raised (Hammer, et al., 2013).

Analgesic Activity

Swiss albino mice, common subjects in biomedical research due to their genetic homogeneity, were administered an oil preparation containing *Cinnamomum camphora*, Menthol, and Thymol. This formulation, selected for its potential therapeutic effects, was tested at doses of 110 mg/kg and also 250 mg/kg (Ghori, et al., 2016)].

Table 3: Analgesic Activity in Mice Using Hot Plate Method at Different Intervals of Time

Treatment Group	Dose (mg/kg) Initial	Reaction Time in Minutes (mean ± SEM) 30	Sig
Control	10 ml/kg	1.46 ± 0.11	1.000
Diclofenac Sodium	50 mg/kg	1.81 ± 0.20	0.0005
Test-1	100 mg/kg	1.61 ± 0.41	0.0083
Test-2	200 mg/kg	1.83 ± 0.23	0.0067

Note: P<0.01 considered significant, **P<0.001** extremely significant.

Table 4: Paw Volumes of Rats in Different Experimental Groups

Treatment Group	Dose (mg/kg) 0h	Paw Volume (mean ± SEM) at Different Hours 1h	Sig
Control	5 ml/kg	0.50 ± 0.01	1.000
Indomethacin	10 mg/kg	0.76 ± 0.02	0.0005
Test-1	250 mg/kg	0.55 ± 0.02	0.0081

Test-2	500 mg/kg	0.51 ± 0.01	0.0078

Note: P<0.01 significant.

The results from Table 3 (Analgesic Activity in Mice Using Hot Plate Method) indicate that Diclofenac Sodium exhibited a significant increase in reaction time, with the most pronounced effect (P<0.001). Both Test-1 (100 mg/kg) and Test-2 (200 mg/kg) demonstrated a gradual Significant effect. With Test-1 showing a stronger analgesic effect, (P<0.01). The Control group showed minimal response, highlighting the effectiveness of the test substances at higher doses (Xu, et al., 2015).

In Table 4 (Paw Volumes of Rats in Different Experimental Groups), both Test-1 (250 mg/kg) and Test-2 (500 mg/kg) showed a significant reduction in paw volume compared to the Control, With Test-2 yielding a more pronounced decrease at all time points. The effects were similar to the standard Indomethacin group. These findings suggest that the treatments, particularly at the higher dose of 500 mg/kg, possess notable anti-inflammatory properties (Xu, et al., 2015). The composition of camphor oil typically includes 21% of camphor dissolved in an oil base. This formulation finds common use in home remedies for common colds and sinusitis condition due to its purported decongestant properties. Furthermore, camphor used in balms and ointments as analgesics for reduce pain and discomfort (Zhu, et al., 2020).

Antioxidative Activities

Liu et al. and Lee et al. found that the extraction of *Cinnamomum camphora* leaves, rich in flavonoids, demonstrated stronger antioxidant effects compared to other commercially available antioxidant medications. This was evidenced through a free radical scavenging assay using DPPH. Additionally, extracts of butanol and ethanol from *C. camphora* exhibited high efficacy in neutralizing free radicals, indicating significant antioxidant activity (Cardullo & Gilroy, 1975).

Table 5: Effect of Camphor on Rat Thymocyte Cytotoxicity

Concentration (µg/mL)	Cytotoxicity (CCK-8 Assay) (Absorbance Ratio ± SD)	Significance (vs. Control)
0.5	0.927 ± 0.132	-
5	1.024 ± 0.083	-
50	1.111 ± 0.033	*

Control	0.999 ± 0.005	-

Table 6: Effect of Camphor on Intracellular ROS Production

Concentration (µg/mL)	Intracellular ROS Production (Ratio ± SD)	Significance (vs. Control)
0.5	1.413 ± 0.068	***
5	1.399 ± 0.093	**
50	1.251 ± 0.049	*
Control	1.000 ± 0.042	-

The analysis of camphor's effects on rat thymocytes reveals significant findings regarding cytotoxicity and oxidative stress. In terms of cytotoxicity, camphor demonstrated a concentration-dependent increase in toxicity, as measured by the CCK-8 assay. At a concentration of 50 µg/mL, a statistically significant increase in cytotoxicity ($*p < 0.05$) was observed compared to control cells, while lower concentrations (0.5 and 5 µg/mL) did not show significant changes (Farasati Far, et al., 2023).

Regarding intracellular reactive oxygen species (ROS) production, camphor induced a notable rise in ROS levels across all tested concentrations. The most pronounced increase was at 0.5 µg/mL, with a highly significant change ($**p < 0.001$) compared to controls. At 5 µg/mL, the increase was also significant ($**p < 0.01$), and at 50 µg/mL, a moderate but still significant rise was observed ($*p < 0.05$). These results indicate that camphor's cytotoxicity may be partially mediated by oxidative stress (Valdez, et al., 2019).

Overall, camphor's impact on rat thymocytes highlights its potential to induce cytotoxic effects and elevate oxidative stress at higher concentrations. Further studies exploring mitochondrial membrane potential and other markers of cellular health could provide deeper insights into the mechanisms underlying these effects (Sweetman, 2018).

Antipruritic and counterirritant

Camphor demonstrates the capacity to activate TRP and TRPV1 channels at the level of the dorsal root ganglion, while also inhibiting TRPA1 channels. Consequently, it functions as a TRPV1 agonist. This activity contributes to the antipruritic and counterirritant effects observed in camphor (*Soodan*) (Xu, et al., 2015).

Pharmacokinetics

Camphor exhibits good absorption across various routes of administration, including intranasal, intraoral, and topical application. Orally, it enters the bloodstream independently within three hours, but when combined with solvents like Tween 80, it reaches plasma levels within one hour. Dermal application results in relatively slower absorption compared to other routes. However, caution is advised during pregnancy and lactation, as camphor can cross the placenta and distribute throughout the body. It has a plasma protein binding capacity of 61%. Following absorption, camphor is metabolized in the liver, and its metabolites are conjugated with glucuronic acid and excreted via urine. The half-life of camphor significantly decreases when combined with solvents like Tween 80 (Masuram, et al., 2014).

In topical application, the rate of absorption is higher than the volume of absorption. A study demonstrated that after applying camphor topically, small patches were formed on the skin, facilitating absorption (Masuram, et al., 2014).

Relationship based on the Siddha aspect

According to siddha philosophy, wounds develop as a result of *vatha dosha* imbalance. It will have an impact on the *charam* and *cenneer*. It will then have an impact on other *thathukal* and cause a wound. Initially the *vatha dosha* influences, then the *pitha dosha* then the *kapha dosha.* The disease becomes more severe as a result. Thus, the medication used to treat wounds should balance the three *doshas* of *vata, pitta, and kapha* (Thanushiyan, et al., 2024). *Soodan* has a powerful ability to aggravates *pitham*, while it lowers down *Vatham* and *Kabham*. It tastes bitter and pungent. In contrast to aggravating *pitham* and *vatham*, it reduces *kapham* (Thanushiyan, et al., 2024). To heal a wound, a medicine should balance the *tridoshas*, according to Siddha philosophy. This medication has a hot potency and a pungent, bitter taste. Combinations can maintain the equilibrium of the *tridosha* and balance the *vatha, pitha*, and *kabha doshas*. Therefore, it is obvious that the *Soodan* is helpful at promoting wound healing.

CONCLUSION

In conclusion, *Soodan* (Camphor), derived from *Cinnamomum camphora*, demonstrates a range of pharmacological actions, including antibacterial, antifungal, analgesic, anti-inflammatory, antioxidative, and counterirritant effects, all of which contribute to its wound healing potential. The rich phytochemical composition of camphor underpins these therapeutic properties, with key compounds such as camphor, borneol, and monoterpenes playing vital roles in tissue repair and infection control. Studies have shown that *Soodan*, particularly in

topical formulations like ointments, can effectively promote wound healing, potentially offering an alternative to synthetic drugs. However, pharmacokinetic studies highlight the rapid absorption of *Soodan* and its hepatic metabolism, with caution advised during pregnancy and lactation due to its ability to cross the placenta. While *Soodan* exhibits promising potential, further research is needed to optimize its use in modern medical settings, including precise dosage and formulation guidelines. Future studies should focus on in depth clinical trials, exploring the efficacy of different *Soodan* concentrations and its safety profile across diverse patient populations. Additionally, further research should address the long-term effects and any potential interactions with other medications.

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LIST OF ABBREVIATIONS

1. NADH - Nicotinamide adenine dinucleotide
2. DCPIP - Dichlorophenolindophenol
3. MIC - Minimum inhibitory concentrations
4. TRPV1 - Transient receptor potential V
5. TRP - Transient receptor potential

LEGEND

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REFERENCES

Amini, Masood & Kherad, Masoomeh & Mehrabani, Davood & Azarpira, Negar & Panjeshahin, Reza & Tanideh, Nader. (2015) 'Effect of Plantago major on Burn Wound Healing in Rat', Journal of Applied Animal Research, 37(1), pp. 53-56.

Cardullo, M. A. and Gilroy, J. J. (1975) 'Inhibition of oxidative metabolism in Escherichia coli by d-camphor and restoration of oxidase activity by quinones', Canadian Journal of Microbiology, 21(9), pp. 1357-1361.

Chambliss, L. R. (2010) 'Alternative and Complementary Medicine: An Overview', Clinical Obstetrics and Gynaecology, 44(4), pp. 640–652.

Chen J, Tang C, Zhang R, Ye S, Zhao Z, Huang Y, Xu X, Lan W, Yang D. (2020) 'Metabolomics analysis to evaluate the antibacterial activity of the essential oil from the leaves of Cinnamomum camphora (Linn.) Presl', Journal of Ethnopharmacology, 253, p. 112652. https://doi.org/10.1016/j.jep.2020.112652.

DeCarlo, A., Zeng, T., Dosoky, N. S., Satyal, P., and Setzer, W. N. (2020) 'The essential oil composition and antimicrobial activity of Liquidambar formosana oleoresin', Plants, 9(7), p. 822. https://doi.org/10.3390/plants9070822.

Elfadil, H., Fahal, A., Kloezen, W., Ahmed, E. M., and van de Sande, W. (2015) 'The in vitro antifungal activity of Sudanese medicinal plants against Madurella mycetomatis, the eumycetoma major causative agent', PLoS Neglected Tropical Diseases, 9(3), p. e0003488. https://doi.org/10.1371/journal.pntd.0003488.

Farasati Far, B., Behzad, G., and Khalili, H. (2023) 'Achillea millefolium: Anti oxidative mechanism of action, pharmacokinetics, clinical drug-drug interactions and tolerability', Heliyon, 9(12), p. e22841.

Guo S, Geng Z, Zhang W, Liang J, Wang C, Deng Z, Du S. (2016) 'The chemical composition of essential oils from Cinnamomum camphora and their insecticidal activity

against the stored product pests', International Journal of Molecular Sciences, 17, p. 1836. https://doi.org/10.3390/ijms17111836.

Hammer, K. A., Carson, C. F., and Riley, T. V. (2013) 'Antifungal activity of the components of Melaleuca alternifolia (tea tree) oil', Journal of Applied Microbiology, 95(4), pp. 853–860. https://doi.org/10.1046/j.1365-2672.2003.02059.x.

Hercogov, J. (2005) 'Topical anti-itch therapy', Dermatology Therapy, 18, pp. 341-343.

Inoue, Y. and Takeuchi, S. (1969) 'Expectorant-like action of camphor derivatives', Nippon Ika Daigaku Zasshi, 36(4), pp. 351-354.

Lee HJ, Hyun EA, Yoon WJ, Kim BH, Rhee MH, Kang HK, Cho JY, Yoo ES. (2016) 'In vitro anti-inflammatory and anti-oxidative effects of Cinnamomum camphora extracts', Journal of Ethnopharmacology, 103, pp. 208-216.

Liu RS, Wei GQ, Yang Q, He WJ, Liu WY. (2002) 'Cinnamomin, A Type II Ribosome-Inactivating Protein, Is A Storage Protein in the Seed of the Camphor Tree (Cinnamomum camphora)', Biochemical Society Journal, 362, pp. 659–663.

Masuram S, Rask-Andersen M, Schiöth HB. (2014) 'The druggable genome: Evaluation of pharmacokinetics of the drug targets in clinical trials suggests major shifts in molecular class and indication', Annual Review of Pharmacology and Toxicology, 54, pp. 9-26.

Mishra & Dwivedi, Suresh & Kishore, Nameeta & Dubey, N. (2018) 'Fungistatic properties of essential oil of Cinnamomum camphora', International Journal of Pharmacognosy, 29(4), pp. 259-262.

Moglad, E. H., Hamad, A. M., Fatima, F., Seshadri, D. V., and Naz, M. (2020) 'Antimicrobial and wound healing activities of certain Sudanese medicinal plants', Saudi Journal of Biological Sciences, 27(7), pp. 1766-1772.

Nadkarni, K. M. (2010) Indian Materia Medica, Vol. I. Popular Prakashan, Bombay, pp. 250-253.

Pragadheesh, V. P. P. S., Yadav, A., Singh, M., and Chanotiya, C. S. (2017) 'Characterization of Volatile Components of Zingiber roseum Essential Oil Using Capillary GC on Modified Cyclodextrins', Natural Product Communications, 8(2).

Salman, A. S., Farghaly, A. A., Donya, S. M., and Shata, F. (2012) 'Protective Effect of Cinnamomum camphora Leaves Extract Against Atrazine Induced Genotoxicity and Biochemical Effect on Mice', Journal of American Science, 8(1), pp. 190–196.

Singh, R. and Jawaid, T. (2012) 'Cinnamomum camphora (Kapur): Review', Pharmacognosy Journal, 4(28), pp. 1-5.

Sweetman, S. C. (ed.) (2018) Martindale: The Complete Drug Reference. 34th ed. London: The Pharmaceutical Press.

Tuntarawongsa, S. and Phaechamud, T. (2012) 'Menthol, Borneol, Camphor and WS-3 Eutectic Mixture', Advanced Material Research, 506, pp. 355–358.

Thanushiyan, V., Vijayarajah, M., and Mithurendran, B. (2024) 'Evaluation of wound healing activity of Soodan (Camphor) powder and ointment in Wistar albino rats', World Journal of Pharmaceutical Research, 13, p. 1574. https://doi.org/10.20959/wjpr20249-32146.

Thiyagarajan, R. (1995) Siddha Maruthuvam Sirappu. Chennai: Sri Venkateshwara Enterprises, pp. 292-296.

Thiyagarajan, R. (2009) Gunapadam (Dhathu Jeeva Vaguppu). Chennai: Sri Venkateshwara Enterprises, pp. 402-404.

Vajiravelu, Sivamurugan & Anbarasu, Murugan & Ponmudi, Priya & Jeya, Gopal & Dhanalakshmi, Ravikumar & Vinitha, Viswanathan. (2019) 'Overview of Wound Healing Siddha Medicines', Open Access Journal of Complementary and Alternative Medicine, pp. 92-94.

Valdez, J. S., Martin, D. K., and Mayersohn, M. (2019) 'Sensitive and selective gas chromatographic methods for the quantification of camphor, menthol, and methyl salicylate

from human plasma', Journal of Chromatography B: Biomedical Science and Applications, 729(1-2), pp. 163-171.

Viljoen, A., van Vuuren, S., Ernst, E., Klepser, M., Demirci, B., Başer, H., and van Wyk, B. E. (2003) 'Osmitopsis asteriscoides (Asteraceae) - the antimicrobial activity and essential oil composition of a Cape-Dutch remedy', Journal of Ethnopharmacology, 88, pp. 137–143. https://doi.org/10.1016/s0378-8741(03)00191-0.

Wang L, Zhang K, Zhang K, Zhang J, Fu J, Li J, Wang G, Qiu Z, Wang X, Li J. (2020) 'Antibacterial activity of Cinnamomum camphora essential oil on Escherichia coli during planktonic growth and biofilm formation', Frontiers in Microbiology, 11, p. 561002. https://doi.org/10.3389/fmicb.2020.561002.

Xu, H., Blair, N. T., and Clapham, D. E. (2015) 'Camphor activates and strongly desensitizes the transient receptor potential vanilloid subtype 1 channel in a vanilloid-independent mechanism in analgesic activity', Journal of Neuroscience, 25(39), pp. 8924-8937.

World Health Organization (2008) 'Traditional medicine Fact sheet'. Available at: https://www.who.int/health-topics/traditional-complementary-and-integrative-medicine [Accessed 21 August 2023].

Zhu, H., Xie, H., and Zhang, Y. (2020) 'Antioxidant, anti-inflammatory, and wound healing properties of Cinnamomum camphora essential oil and its application in wound healing formulations', Journal of Ethnopharmacology, 247, p. 112317.