

PHILIPPINE STINGLESS BEES PROPOLIS: MEDICINAL PROPERTIES AND PROSPECTS FOR ANIMAL & HUMAN HEALTH

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ABSTRACT

The Philippine stingless bee (*Tetragonula biroi* Friese) propolis contains different bioactive compounds that are responsible for its medicinal properties to address various disease condition. Utilizing different models of wounds like full thickness incisional, sutured, surgical, and burn wounds and bed sores, treatment with our locally developed sterile propolis wound dressing significantly hastened the healing rate of these wounds through significant reduction of inflammation, exudation, faster wound apposition, and prevented the development of pus formation and necrosis. The potent anti-inflammatory activity is attributed to propolis capacity to down regulate the pro-inflammatory cytokines TNF α , IL1 β and IL6. Furthermore, propolis exhibit remarkable anti-pain activity against somatic and cutaneous pain associated with the occurrence of wounds. Histopathologic examination of wound sites showed re-epithelialization and intact dermal matrix with fast growth of hair follicles and sebaceous glands with propolis wound dressing treatment. The hair growth promoting effect of propolis is through stimulation of hair follicles development by activating the Wnt/ β -catenin signaling pathway. Cost benefit analysis shows huge savings with treatment of propolis wound dressing. Collectively, these information infer the uniqueness and high potential of the Philippine stingless bee propolis for development of high value biomedical products such as the propolis wound dressing for the management of different types of wounds in animals and humans.

INTRODUCTION

Philippine stingless bee propolis has demonstrated promise as a therapeutic agent, driving investigations into its wound-healing and medicinal properties. Preliminary studies in murine models revealed its ability to accelerate wound closure and modulate key inflammatory pathways. Building on this foundation, subsequent research explored propolis-based treatments in feline surgical and wound management, offering insights into the translational potential of this natural product for both animal and human health applications.

MATERIALS & METHODS

One hundred six (106) male ICR mice underwent dorsal skin preparation followed by the creation of a 1-cm incisional wound and left as is or sutured using non-absorbable material. Standardized treatments (propolis-oliginate, povidone-iodine, fusidate sodium) were applied topically, and progress was monitored over 14 or 21 days.

Subsequent studies used 15 male and 15 female domestic shorthaired cats. They were evaluated in studies involving either a dorsal 3-cm incisional wound and left as is or sutured with non-absorbable material, and surgical wounds from ovariectomies, respectively. Treatments were the same as in the mouse models. Histo-morphometric analysis was performed on biopsy samples to assess collagen formation, epidermal thickness, angiogenesis, and cellular characteristics within the healing tissue. Statistical analysis of total wound scores and healing times was performed, and the cost effectiveness of each treatment was evaluated to provide a holistic view of the interventions.

RESULTS

Table 1. Comparison of mean total wound scores (MTWS), mean duration of wound healing (MDWH) and incidence of wound closure in incisional and sutured wound mice models treated with H₂O₂ + povidone iodine (n=17), fusidate sodium (n=20), and propolis-oliginate (n=16).

Treatment groups	INCISIONAL			SUTURED		
	H ₂ O ₂ + Povidone iodine	Fusidate sodium	Propolis-oliginate	H ₂ O ₂ + Povidone iodine	Fusidate sodium	Propolis-oliginate
MTWS at Day 1	7.00 ± 1.46 ^a	4.85 ± 0.88 ^a	5.88 ± 1.3 ^a	2.60 ± 0.60 ^a	2.50 ± 0.71 ^a	2.39 ± 0.71 ^a
MTWS at Day 14	2.82 ± 2.07 ^a	1.80 ± 1.94 ^a	1.13 ± 1.67 ^a	1.65 ± 1.39 ^a	0.89 ± 1.32 ^a	0.39 ± 0.92 ^a
MDWH (days)	13.71 ± 0.49 ^a	13.17 ± 1.03 ^a	12.42 ± 1.38 ^a	10.71 ± 1.98 ^a	10.33 ± 1.67 ^a	9.00 ± 1.65 ^a
% of mice with healed closed wounds	41.00%	60.00%	75.00%	10.0%	66.67%	83.33%

Table 2. Comparison of mean total wound scores (MTWS) and mean duration of wound healing (MDWH) in incisional and sutured wound feline models treated with H₂O₂ + povidone iodine (n=5), fusidate sodium (n=5), and propolis-oliginate (n=5).

Treatment groups	INCISIONAL			SUTURED		
	H ₂ O ₂ + Povidone iodine	Fusidate sodium	Propolis-oliginate	H ₂ O ₂ + Povidone iodine	Fusidate sodium	Propolis-oliginate
MTWS at Day 1	4.80±0.84 ^a	4.80±0.84 ^a	3.80±0.45 ^a	0.16±0.97 ^a	0.20±0.40 ^a	0.08±0.27 ^a
MTWS at Day 7	5.60±1.95 ^a	4.00±1.58 ^a	1.80±0.45 ^a	0.24±0.59 ^a	0.08±0.27 ^a	0.04±0.20 ^a
MTWS at Day 14	3.40±1.52 ^a	2.20±1.30 ^a	0.20±0.45 ^a	0.00±0.00 ^a	0.00±0.00 ^a	0.00±0.00 ^a
MTWS at Day 21	0.80±0.45 ^a	1.00±0.00 ^a	0.00±0.00 ^a	0.00±0.00 ^a	0.00±0.00 ^a	0.00±0.00 ^a
MDWH (days)	18.00±4.00 ^a	13.00±4.18 ^{ab}	9.00±2.45 ^a	11.20±3.70 ^a	7.40±2.5 ^{ab}	5.00±3.08 ^a

Table 3. Mean total wound scores (MTWS) and mean duration of wound healing (MDWH) in surgical wound feline models treated with H₂O₂ + povidone iodine (n=5), fusidate sodium (n=5), and propolis-oliginate (n=5).

Treatment groups	H ₂ O ₂ + Povidone iodine	Fusidate sodium	Propolis-oliginate
MTWS at Day 1	1.80 ± 0.57 ^a	2.20 ± 0.65 ^a	0.80 ± 0.55 ^a
MTWS at Day 7	2.20 ± 0.58 ^a	2.20 ± 0.58 ^a	1.40 ± 0.61 ^a
MTWS at Day 10	1.20 ± 0.52 ^a	1.20 ± 0.44 ^a	0.00 ± 0.00 ^a
MTWS at Day 14	0.00 ± 0.00 ^a	0.00 ± 0.00 ^a	0.00 ± 0.00 ^a
MDWH (days)	11.60 ± 1.52 ^a	11.60 ± 1.95 ^a	8.80 ± 0.45 ^a

Table 4. Mean (±SD) wound size (mm) of incisional and surgical wounds of cats treated with H₂O₂ + povidone iodine, fusidate sodium, and propolis-oliginate at different periods.

Treatment groups	INCISIONAL			SURGICAL		
	H ₂ O ₂ + Povidone iodine	Fusidate sodium	Propolis-Aliginate	H ₂ O ₂ + Povidone iodine	Fusidate sodium	Propolis-oliginate
Day 0	30.00±0.00	30.00±0.00	30.00±0.00	52.8 ± 0.00 ^a	52.8 ± 0.00 ^a	52.8 ± 0.00 ^a
Day 7	26.29±2.78 ^a	26.87±4.06 ^a	14.80±8.46 ^a	42.18 ± 4.47 ^a	42.45 ± 4.89 ^a	35.24 ± 5.55 ^a
Day 14	14.79±10.47 ^{ab}	22.80±4.23 ^a	3.60±8.05 ^a	0.00 ± 0.00 ^a	0.00 ± 0.00 ^a	0.00 ± 0.00 ^a
Day 21	0.00±0.00	0.00±0.00	0.00±0.00	0.00 ± 0.00 ^a	0.00 ± 0.00 ^a	0.00 ± 0.00 ^a

Table 5. Cost benefit analysis for the different treatment dressings.

Treatment groups	Cost per cat per application (Php/day)	Number of applications in a day	Cost per cat (Php) for duration		
			Incisional wound	Sutured wound	Surgical wound
H ₂ O ₂ + Povidone iodine	47.58	2	1712.88	1065.79	95.16
Fusidate sodium	41.39	2	1076.14	612.57	82.78
Propolis-Aliginate	33.7	2	606.60	337.00	67.40

SUMMARY & CONCLUSION

Tetragonula biroi propolis-oliginate dressings consistently demonstrated enhanced wound healing activity in both murine and feline models. These findings support its potential as an effective and economical veterinary treatment, where the use of normal saline solution for cleaning wounds is more recommendable.

Figure 1. Gross appearance of completely (A-C) and incompletely (D-F) healed incisional wounds of representative mouse treated with H₂O₂ + povidone iodine (A, D), fusidate sodium (B, E), and propolis-oliginate (C, F) dressings at Days 0, 1, 7 and 14. Take note of the complete healing of the wounds at the end of the 14-day treatment period.

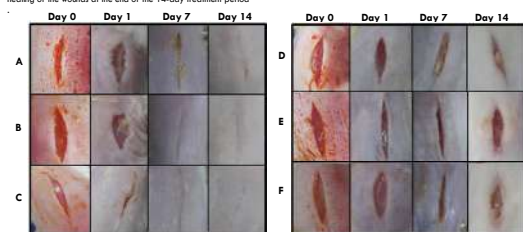


Figure 2. Gross appearance of incisional (A-C) and sutured (D-F) wounds of representative cats treated with H₂O₂ + povidone iodine (A, D), fusidate sodium (B, E), and propolis-oliginate (C, F) dressings at Days 0, 1, 7 and 14.

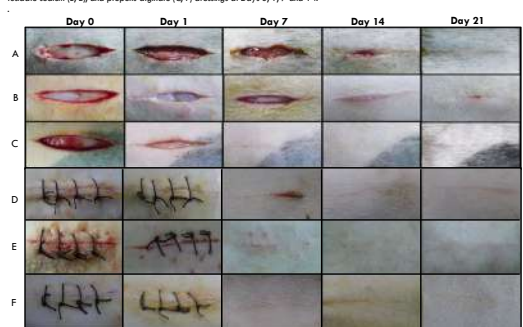


Figure 3. Skin sections from representative incisional (A-C) and sutured (D-F) wounded cats treated with H₂O₂ + povidone iodine (A-C, 14), fusidate sodium (D-F, 14) and propolis-oliginate (G-I, 14) treated cats at Day 7, 14 and 21. Take note of the normal epidermis and intact dermis with hair follicles, blood vessels and sebaceous in the propolis-oliginate treated cats (blue arrows). Marked epidermal thickening and dermal fibrosis were evident in the fusidate sodium and H₂O₂ + povidone iodine cats. There was disorganization of the collagen fibers in the dermis of the H₂O₂ + povidone iodine (C) treated cats. H and E stained.

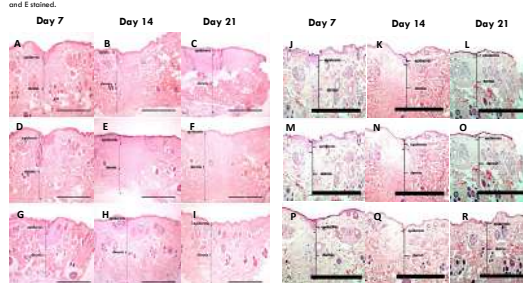
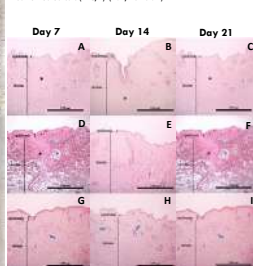


Figure 4. Gross appearance of surgical wounds of representative cats treated with H₂O₂+povidone iodine (A-E), fusidate sodium (F-I), and propolis-oliginate (G-I) dressings at Days 1, 7, 10, 14 and 21. Propolis-oliginate treatment showed faster surgical wound healing compared with the H₂O₂+povidone iodine and fusidate sodium treated cats.

Figure 5. Skin sections of representative cats treated with H₂O₂+povidone iodine (A-C), fusidate sodium (D-F), and propolis-oliginate (G-I) dressings at Days 7, 14, and 21. Complete and rapid re-epithelialization and intact dermal matrix (ex. G-I) with abundant hair follicles and sebaceous glands (H-I, blue arrows) formation were noted in cats treated with propolis-oliginate. Take note of the thicker epidermis, marked dermal fibrosis, few hair follicles and absence of sebaceous glands in the fusidate sodium (D-F, *) and H₂O₂+povidone iodine treated cats (A-C, *) (40x, H&E stain).



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