

ABSTRACT

There are about 180 million diabetic patients in the world and this figure is increasing at an alarming rate. One of the complications due to diabetes is impaired wound healing. About 15% of Type-2 diabetic patients suffer from diabetic foot ulcer (DFU) and 84% of them have their lower leg amputated. Type-1 represents 5 to 10 per cent of diabetes mellitus patients. To date to our knowledge, there is limited success in DFU treatment. The objective of this study was to investigate the effects of *Ganoderma lucidum* aqueous extract in accelerating wound healing in normal and diabetic rats. The freeze-dried powder of aqueous extract of *G. lucidum* was investigated for the rate of healing and wound closure in normal and diabetic rats. Six groups of streptozotocin-induced (Type-1 diabetes) *Sprague Dawley* rats were wounded with 2cm² diameter wound in the dorsal neck region. The wound of negative control animals were treated with aqueous cream, while Intrasite gel was applied to the wounds of positive control animals. The wound of rats in treatment groups were dressed with aqueous cream containing 5%, 10%, 15% and 20% (w/w) aqueous extract of *G. lucidum*. Aqueous cream containing the aqueous extract of *G. lucidum* significantly, ($p < 0.05$) accelerated the rate of wound healing compared to wounds dressed with aqueous cream alone. Aqueous cream containing 10% (w/w) aqueous extract showed the best wound closure quality among the treatment groups. The healed tissue was excised and histological staining was performed using H&E (Haematoxylin & Eosin) and MT (Masson Trichrome) staining to further confirm the healing. Wounds dressed with aqueous cream containing 10% *G. lucidum* extract showed markedly less scar width at the wound closure, had large numbers of fibroblast proliferation, more mature and densely packed collagen with accompanying angiogenesis in the healed tissue compared to wounds dressed

with aqueous cream alone. These results were indicative of the beneficial effects of *G. lucidum* on wound healing and closure in diabetic rats. Furthermore, aqueous extract of *G. lucidum* increased antioxidant capacity in both serum of normal and diabetic rats through external application and the advanced oxidation protein products (AOPP) and lipid hydroperoxides products (LHP) in diabetic rats were due to the untreated diabetes during the period of experiment.

ABSTRAK

Terdapat lebih kurang 180 juta pesakit diabetes di dunia dan angka ini kian meningkat pada kadar yang membimbangkan. Salah satu komplikasi penyakit diabetes ialah penyembuhan luka yang tidak selaras. Hampir 15% daripada pesakit Type-1 diabetes menderita akibat ulser kaki diabetes (DFU) dan kaki 84% pesakit DFU kebiasaannya akan dipotong. 5 hingga 10 peratus pesakit adalah Type-1 diabetes. Berdasarkan pengetahuan kami setakat ini, keberkesanan dan kejayaan untuk merawat DFU adalah terhad dan rendah. Maka, objektif kajian ini adalah untuk mengkaji kesan ekstrak akues *Ganoderma lucidum* dalam mempercepatkan penyembuhan luka dalam tikus biasa dan diabetik. Ekstrak akues dikeringkan melalui proses pembekuan kering. Disamping itu, kesan ekstrak *G.lucidum* terhadap kadar penyembuhan dan penutupan luka tikus biasa dan diabetik juga dikaji. Enam kumpulan tikus *Sprague Dawley* diabetik yang diaruhkan dengan streptozotolin dcederakan di kawasan leher dorsal dengan luka yang berdiameter 2cm². Luka haiwan kumpulan kawalan telah dirawat dengan krim akues, luka haiwan kumpulan kawalan positif dirawat dengan gel komercial *Intrasite*, manakala luka haiwan kumpulan rawatan dirawat dengan krim akues yang mengandungi 5%, 10%, 15% and 20% (w/w) ekstrak akues *G. lucidum*. Hasil kajian mendapati krim akues yang mengandungi ekstrak *G. lucidum* mempercepatkan ($p < 0.05$) kadar penyembuhan luka tikus diabetik berbanding luka tikus diabetik yang disapu dengan krim akues sahaja. Namun, krim akues yang mengandungi 10% ekstrak mentah menunjukkan hasil penyembuhan luka yang terbaik dengan penutupan luka yang rapi seperti dijahit. Tisu dari luka yang telah sembuh dipotong dan pewarnaan histologi dilakukan dengan kaedah pewarnaan H&E (Hematoxylin & Eosin) dan MT (Masson Trichrome) untuk mengesahkan hasil kajian. Luka yang disapu dengan krim akues

yang mengandungi ekstrak *G. lucidum* menunjukkan pengurangan parut ketara pada penutupan luka, mengandungi sebilangan besar pergerakan fibroblast, kolagen yang lebih matang dan padat disertai angiogenesis berbanding luka yang hanya disapu dengan krim akues sahaja. Keputusan kini menunjukkan kesan berfaedah *G. lucidum* pada penyembuhan dan penutupan luka untuk tikus diabetik. Selanjutnya, ekstrak akues *G. lucidum* meningkatkan kapasiti antioksidan dalam tikus biasa dan diabetik melalui krim yang disapu pada luka. Advanced produk pengoksidaan protein (AOPP) dan lipid produk hydroperoxides (LHP) dalam tikus diabetik adalah akibat dari keadaan diabetik yang tidak dirawat sepanjang masa kajian.

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