Abstract

Wounds are one of the most dangerous problems in the world. Silkworm *Bombyx mori* naturally produces a protein called sericin. A naturally occurring biomaterial called sericin promotes the growth of fibroblasts and keratinocytes, which aids in the healing of wounds. Due to its antibacterial, anti-inflammatory, and antioxidant properties, curcumin may also aid in the healing of wounds. In the current investigation, sericin and turmeric were used to prepare their conjugated silver nanoparticles using silver nitrate ($AgNO_3$). Synthesis of nanoparticles was confirmed by UV spectroscopy and then characterized by Fourier transform infrared spectroscopy (FTIR) and Scanning electron microscopy (SEM). In this study, the effects of sericin, turmeric root extracts, and their nanoparticles on bacteria, diabetic wounds, burn wounds, and DPPH are being examined both individually and in combination. Groups of two-month-old female mice, each weighing 29–30 g, were randomly assigned. There were five mice added to every group. Mice were given burn wounds with the use of a heated metal rod. For diabetic wounds, the current study utilized alloxan monohydrate to induce diabetes. After that excision wounds were created in diabetic mice using a biopsy puncture (6 mm). Wounds were evaluated histologically and morphologically.

Turmeric nanoparticles exhibited maximum inhibition of *Brevibacillus fortis* with inhibitory zone of 18.5±0.3 mm. On the other hand, *Escherichia coli* and *Staphylococcus aureus* showed zone of inhibition of 17.3±0.7 mm and 17.1±0.5 mm respectively. The minimum antibacterial activity of turmeric nanoparticles was observed against *Pseudomonas maltophilia* (12.2±0.6 mm). *In vitro* antioxidant activity of sericin, turmeric and their nanoparticles were also performed at 50 µg/ml, 100 µg/ml, 150 µg/ml and 200 µg/ml. The highest antioxidant activity was shown by turmeric nanoparticles (71.4±1.1%) at 200 µg/ml.

When compared to other treatment groups and the negative control group, turmeric nanoparticles significantly enhanced the wound contraction area in burn wounds. Turmeric nanoparticles group was healed on 17 days. While, the negative control group was healed on the 29th day and the positive control group was completely

healed on the 21st day. Glutathione (4.9±0.1 umol/L), Glutathione peroxidase (183.4±5.1 U/L), Superoxide dismutase (194.6±5.1 U/ml) and Catalase (6.0±0.2 mmol/ml) were among the pro-inflammatory enzymes that were significantly higher in the turmeric nanoparticles group in burn wounds than in the negative control group (2.8±0.1 umol/L, 87.8±3.0 U/L, 92.0±4.8 U/ml, 3.5±0.1 mmol/ml, and respectively). In contrast to the negative control group (7.4±0.2 mmol/L), the lowest amounts of Malondialdehyde (3.8±0.2 mmol/L) were seen in this group. The usefulness of turmeric, sericin, and nanoparticles was further shown by histopathological research. Additionally, it was noted that in turmeric nanoparticles group in comparison with the other groups, the epidermis was restored more quickly.

Diabetic wounds treated with turmeric nanoparticles were cured in 13 days and their wound contraction was 97.4±1.2%. While the wounds of the diabetic control group (saline) and the positive control group (polyfax) showed a contraction of 44.7±1.9% and 69.9±1.6% respectively. Turmeric nanoparticles significantly decrease the serum level of Matrix metalloproteinases 2 (207.6±15.3 pg/ml), Matrix metalloproteinases 7 (241.4±8.4 pg/ml), Matrix metalloproteinases 9 (147.8±10.2 pg/ml), Tumor necrosis factor-α (14.8±1.0 pg/ml), Interleukin-6 (7.4±0.4 pg/ml), and Interleukin-8 (16.8±1.1 pg/ml) to the diabetic control. Tissue inhibitors matrix metalloproteinases level (193.0±6.7 pg/ml) was significantly increased in the group treated with turmeric nanoparticles as compared to the diabetic control group. Histopathological analysis of the turmeric nanoparticles group also exhibited an increase in the number of blood vessels, keratinocytes, fibroblasts, and enhanced growth of collagen fibers. In conclusion, turmeric, sericin and their nanoparticles are effective antibacterial and antioxidant agents and these biomaterials also improve the healing process of burn and diabetic wounds.

Key words: Diabetic Wound, Burn wounds, Turmeric, Sericin, Biochemical Parameters