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Synergistic Effect of Photobiomodulation and Vanillin on Energy Metabolism in Diabetic Wounded Cells In Vitro

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Delayed wound healing is among the major peripheral complications of diabetes. Synergistic treatment of diabetic wounds with phytochemicals and non-invasive techniques such as photobiomodulation (PBM) has shown promising results. Cells rely on glucose metabolism for the generation of adenosine triphosphate (ATP) for energy utilization. However, glucose metabolism is altered in diabetic wounds and contributes to delayed healing. The present study investigated the synergistic effect of vanillin and PBM and their modulatory effect on energy metabolism in diabetic wounded (DW) modeled fibroblast cells (WS1). DW cells were treated with vanillin and vanillin + PBM (at 660 nm with a fluence of 5 J/cm² for an irradiation time of 780 s). Controls consisted of WS1 cells, untreated DW cells, and DW cells treated with PBM. There was an increase in the activities of fructose-1,6-biphosphatase, glucose 6-phosphatase, and E-NTPDase, with concomitant suppressed activities of glutathione reductase and glyoxalase, following induction of DW. Treatment with vanillin (12 ug/mL) and vanillin (6 ug/mL) + PBM significantly reversed these activities and closed the wounds while maintaining the cells' morphology. These results indicate the synergistic therapeutic effect of vanillin + PBM on the management of diabetic wounds, with vanillin (6 ug/mL) + PBM displaying the best effect.

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