Laser activation for penetration of turmeric extract cream (Curcuma longa) into rat skin tissue (Wistar strain)

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Introduction

Low Level Laser Therapy (LLLT) of 650 nm and energy of 1 Joule could reduce the necrosis and increase the normal cells by repairing renal tubular cells on mice [63,64,65,2]. In the other hand, the used of 592 nm and 628nm LED could also help the wound healing process caused by Staphylococcus bacteria on mice skin up to 88% and 94% respectively, while the combination of both LED could heal up to 95% [5,6]. These phenomena happened because each tissue had a different absorption and scattering coefficient, depended on the wavelength of light source. The wavelength of a light source was an essential parameter, the higher the wavelength, the deeper the tissue penetration was [5]. Klorof1[8,9] and dian curcumin were natural substances that sensitive to light, curcumin had a good chromogenic characteristic to generate high fluorescence, visible excitation on visible light, and wavelength emission [9]. In vivo method was carried out for skin analysis to testify the laser activation for penetration on the rat (gallar Wistar) skin tissue by turmeric extract cream using a fluorescence microscope.

Materials & Methods

Light Source (L)
1. Green Laser (L1) (523 ± 0.05) mW
2. Red Laser (L2) (661 ± 0.05) mW
3. Blue Laser (L3) (453±0.05) mW
4. Infrared Laser (L4) (979 ± 0.05) mW, LS was at 20-21%/2 of energy density

Curcuminoid (CCD) Contents
The determination of turmeric rhizomes was done by UPT Purbawati Botanical Garden Conservation Center-UPJ. 100 gr of dry turmeric rhizome powder was extracted by methanol extraction for 9 days with ethanol 95% (plainthaw, teflon, w/v).

Determination of Curcumin Contents (CCD)
Standard CCD concentration of 100 - 150 ppm was obtained by dissolving CCD standard in ethanol p.a to a concentration of 1.000 ppm and then applied on TLC (50x254 x 10 cm, Merck, Germany) plate along with curcuminoid samples that had been dissolved in ethanol p.a.0.200 mg/ml. The TLC plate was then eluted using hexane:ethyl acetate (3:1) in mobile phase, then each plate was dried in air and scanned at 365 nm using CAMAG and WinCats software. The peak areas of each active compounds in turmeric extract, Cur, were calculated.

The method of peak purity and peak integration against R = 74% (LOD) and R = 75% (LOD) was used. The use of Raman spectroscopy instrument can also be used to find out any degradation substance after laser irradiation so that the tissue activity can be analyzed. Further research of factor that caused L did not affect on turmeric extract penetration is needed. Drug dissolution can be used to observe the laser effect on turmeric extract penetration, but this method is quite time-consuming.

The laser effect on tissues was different and showed by the energy of a photon in each depth. According to the theory from Prasad (2005), the lower the wavelength, the higher the photon energy since Equation 2 also implied that the depth of laser penetration could be calculated using Equation 2, the wavelength peak of extracted CCD was pure (not contaminated). The wavelength peak of turmeric extract was 417 nm. The levels of CCD in skin tissues were calculated using linear regression of y = 4,92x - 2829.813 with r = 0.99957 and y0 = 0.73%. W0 was <5%, and another requirement for tissue penetration is 2.12% (b/v).

Penetration Test

Skin Scoring (a) Observation data (b) Literature data

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1. Fluorescence on the top of epidermis until stratum granulosum
2. Fluorescence on stratum spinosum until stratum basalis
3. Fluorescence was visible until the top of the dermis
4. Fluorescence was visible until the lower dermis

Further research of factor that caused L did not affect on turmeric extract penetration is needed. Drug dissolution can be used to observe the laser effect on turmeric extract penetration, but this method is quite time-consuming. The use of Raman spectroscopy instrument can also be used to find out any degradation substance after laser irradiation so that the tissue activity can be analyzed. Further research of injection rat with specific disease and treated using L3 + TEC also can be done to find out the role or activity of laser for tissue penetration on the skin rat.

References