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Photo-damages by chronic Infrared-A Irradiation for human dermal fibroblasts

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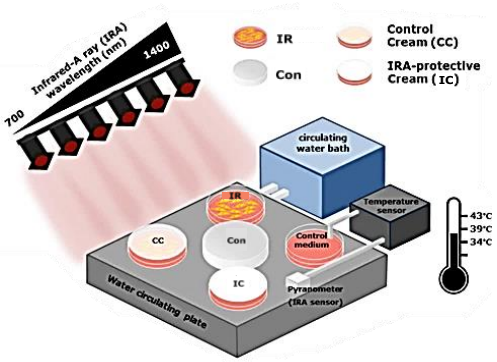
Jun Bae Lee[1], Hyejung Mok[2], Gayeon You[2], Su Ji Kim[1], Jiwon Yang[2] , Song Jihyun[2]

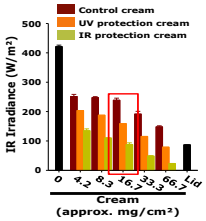
[1]R&I Center, COSMAX, Seongnam, Korea, Republic of (South); [2]Konkuk University, Seoul, Korea, Republic of (South)

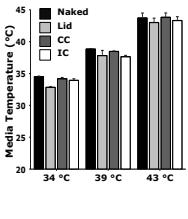
Introduction:

Infrared radiation is closely related with skin diseases like photodermatosis, wrinkle formation, and erythema. Infrared-A (IRA, 700 to 1400 nm) radiation consists of about 30% of solar infrared radiation to get through the hypodermis and affect diverse types of cells on the skin. Although the effect of IRA irradiation on skin cells was studied in previous studies, its effects are controversial because of various irradiation conditions, e.g. intensity of irradiation, exposure term, and temperature. This study shows cellular responses to chronic and mild levels of IRA exposure with different times and doses of irradiation to human dermal fibroblast cells harvested from two types of donors. Cellular apoptosis and reactive oxygen species (ROS) were analyzed by staining with DCFH-DA, MitoSOX, and Annexin V. Induction of photoaging was also examined by morphological change of fibroblasts.

Materials & Methods:



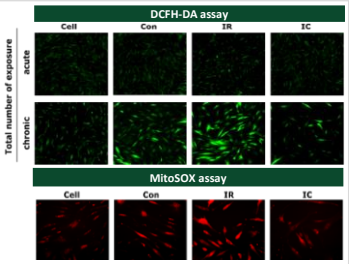




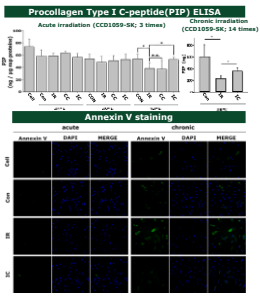
- Schematic illustration of periods and controlled experimental conditions on Infrared-A irradiation
- IRA level exposed in this study is 42 mW/cm² as IRA level in solar sunlight is ~20-45 mW/cm² for a day.
- The daily dose of IRA irradiation (604.8 ± 14.4 J/cm²) was exposed during the periods as it was ~ 800 J/cm² previous study.
- IRA was exposed at 34℃.
- The number of acute and chronic irradiation were 3 and 14 times in fibroblasts (CCD), respectively.
- The number of acute and chronic irradiation were 3 and 6 times in fibroblasts (NHDF), respectively.

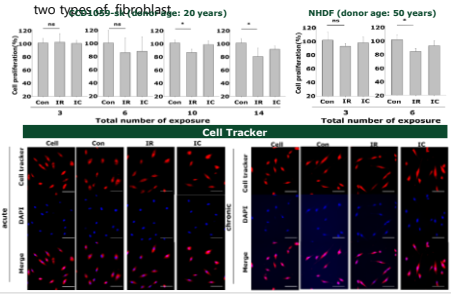
Results & Discussion:

- Intracellular and Mitochondrial ROS
  - DCFH-DA assay
    - Intracellular ROS detection
  - MitoSOX assay
    - Mitochondrial ROS detection



- The protein expression level of collagen and cellular apoptosis and proliferation during acute and chronic IRA irradiation
  - The protein expression level of collagen analyzed by PIP ELISA
  - Apoptosis analyzed by Annexin V staining
  - Cell proliferation
    - Chronic IRA reduced cell proliferation differ from two types of fibroblast.





Conclusions:

- Chronic IRA caused high mitochondrial and cellular ROS, and then induced cellular apoptosis and decreased cellular proliferation.
- Increased expression level of sa-β-gal and the elongated length showed the induction of aging in fibroblasts after chronic IRA irradiation rather than acute IRA irradiation.
- Taken together, it is crucial to protect skin from harmful damages by chronic infrared-A for healthy skin and well aging during daily life.

Acknowledgements:

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References:

- Krutmann J, Bouloc A, Sore G, Bernard BA, Passeron T. The skin aging exposome. J Dermatol Sci. 2017, 85, 152-161.
- Krutmann J, Schalka S, Watson REB, Wei L, Morita A. Daily photoprotection to prevent photoaging. Photodermatol Photoimmunol Photomed. 2021, 37, 482-489.
- Ali SM, Ali U. An approach to design a wristwatch for the protection of the human skin damage induced by ultraviolet and infrared radiations. Photodermatol Photoimmunol Photomed. 2020, 36, 278-289.
- Kim JY, Kim SJ, You G, Choi ES, Lee JH, Mok H * and, Lee JB*, *Biotechnology and Bioprocess Engineering*, 2021, 26, 595-605
- Yang J, Song J, Kim SJ, You G, Lee JB *, and Mok H*, *Photodermatology, Photoimmunology & Photomedicine* 2022, *in press.*