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LED-based UV irradiation safely prevents the loss of bone and muscle mass in mice

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A research team at Nagoya University in Japan has revealed that narrow-range ultraviolet (UV) irradiation using light emitting diodes (LEDs) safely increases serum vitamin D levels in aging mice and thereby prevents the loss of their bone and muscle mass. The findings were recently published in the journal *Scientific Reports*.

Decreased bone density (osteoporosis) and the loss of muscle mass and strength (sarcopenia) are age-related disorders. While there are some remedies for osteoporosis, there is no effective treatment for sarcopenia. Recently, a condition called osteosarcopenia—osteoporosis and sarcopenia together—which impedes the daily life activities of the sufferer, has also been observed among many elderly people.

Vitamin D is essential for healthy bones and muscles, and its deficiency is a possible cause of osteosarcopenia. Vitamin D can be produced when the skin is exposed to sunlight. However, the availability of sunlight depends on various factors like latitude, season, weather and patient mobility, which makes it difficult to obtain vitamin D consistently from sunlight alone. Indeed, it is known that many elderly people have a vitamin D deficiency.

The research team, consisting of Prof. Yoshihiro Nishida, Dr. Kazuya Makida, and colleagues at the Nagoya University Graduate School of Medicine, has been working to establish a method of supplying vitamin D in a safe and stable manner at low cost. "Unlike sunlight, LED-based UV irradiation could be a consistent and stable source of vitamin D,"

says Dr. Makida.

In a previous study, the team had revealed that narrow-range UV irradiation using LEDs—which is an energy efficient light source—increased serum vitamin D levels in animal models with vitamin D deficiency and thereby prevented their bone weakness. However, due to its wavelength and intensity, the UV-LED irradiation could have harmful effects on the human body.

In the new study, the team first conducted experiments to determine the minimal intensity and the minimal dose of UV-LED irradiation that would supply sufficient vitamin D with few side effects. The minimal intensity was found to be 0.16 mW/cm^2 and the minimal dose 1,000 J/m^2.

Next, senescence-accelerated mice (mice bred with accelerated aging effects) were irradiated by UV-LEDs set to these levels. As a result, the serum vitamin D levels, bone density, and muscle mass and strength were all observed to increase compared to those of mice that were not irradiated. The researchers also verified that the UV-LED irradiation did not damage the skin of the mice. Therefore, they concluded, irradiation with narrow-range UV-LED light with minimal intensity and dose can safely and adequately supply vitamin D to aged mice, thereby preventing osteosarcopenia.

The team is now developing a small portable UV-LED irradiation device. "This device could prevent or cure osteosarcopenia without medicine," says Professor Nishida. "It's a new concept of medical device that can be used in various healthcare institutions and at home. It will also reduce the burden on people who care for immobile elderly people. With this device, all elderly people will be able to get enough vitamin D, the same amount or more than from sunlight, in an easy and safe manner at low cost. It could be a promising approach for the prevention and

treatment of this disease."

The study, "Low energy irradiation of narrow-range UV-LED prevents osteosarcopenia associated with vitamin D deficiency in senescence-accelerated mouse prone 6," was published online in *Scientific Reports* on July 17, 2020.

More information: Kazuya Makida et al, Low energy irradiation of narrow-range UV-LED prevents osteosarcopenia associated with vitamin D deficiency in senescence-accelerated mouse prone 6, *Scientific Reports* (2020). DOI: 10.1038/s41598-020-68641-8

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