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Defensive effects of fullerene-C60 dissolved in squalane against the 2,4-nonadienal-induced cell injury in human skin keratinocytes HaCaT and wrinkle formation in 3D-human skin tissue model.

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Abstract

We dissolved fullerene-**C60** in squalane (**LipoFullerene**; LF-SQ, **C60**-eq.: 500 ppm) and examined its defensive effects against 2,4-nonadienal (NDA)-induced cell injury in HaCaT keratinocytes and wrinkle formation in three dimensional (3D)-human skin tissue model. NDA is an analog of 4-hydroxynonenal, one of major causes for human body odor indicative of aging and a lipophilic cell injury factor. Cell viability (% of the control) decreased to 31.6% on treatment with NDA (40 microM), but it increased to 66.0-97.5% when LF-SQ of 1-4% (**C60**-eq.: 5-20 ppm) was administered for 5 hr before NDA addition. The defensive effect by LF-SQ was superior to that of "squalane" alone at the same doses. NDA-induced DNA-fragmentation in HaCaT cells was suppressed by LF-SQ administered for 5 hr before NDA treatment, and LF-SQ protected HaCaT cells against apoptosis-like cell death. LF-SQ did not appreciably defend against hydrogen peroxide, though LF-SQ effectively defended against tert-butylhydroperoxide, a type of the intermediate hydrophilicity-lipophilicity degree out of other reactive oxygen species. The scanning electron microscopy demonstrated that NDA caused wrinkles and abnormal scales on keratinocytes of 3D-human skin tissue model, and structural homogeneity of the interstratum was broken, any of which were, however, markedly suppressed with LF-SQ. Squalane alone exhibited defensive effect against the skin tissue injury to some extent, but which was inferior to LF-SQ. LF-SQ might effectively capture and scavenge lipid radicals generated inside the cell membrane, because squalane acts as a lipophilic carrier of **C60**. **C60** dissolved in squalane can be expected to serve as a cosmeceutical ingredient for anti-wrinkle formation.

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