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Diet-induced obesity skin changes monitored by *in vivo* SHG and *ex vivo* CARS microscopy

Dóra Haluszka,[1,2] Kende Lőrincz,[1] Norbert Kiss,[1,2] Róbert Szipőcs,[2,3] Enikő Kuroli,[1] Nóra Gyöngyösi,[1] and Norbert M. Wikonkál[1,*]

[1]*Semmelweis University, Department of Dermatology, Venereology and Dermatooncology, Budapest, Hungary*
[2]*Institute for Solid State Physics and Optics of Wigner RCP, Budapest, Hungary*
[3]*R&D Ultrafast Lasers Ltd, Budapest, Hungary*
[*]*wikonkal.norbert@med.semmelweis-univ.hu*

Abstract: Obesity related metabolic syndrome and type 2 diabetes have severe consequences on our skin. Latest developments in nonlinear microscopy allow the use of noninvasive, label free imaging methods, such as second harmonic generation (SHG) and coherent anti-Stokes Raman scattering (CARS), for early diagnosis of metabolic syndrome-related skin complications by 3D imaging of the skin and the connective tissue. Our aim was to study effects of various types of diet-induced obesity in mice using these methods. We examined mice on different diets for 32 weeks. The collagen morphology was evaluated four times *in vivo* by SHG microscopy, and adipocytes were examined once at the end of experiment by *ex vivo* CARS method. A strong correlation was found between the body weight and the adipocyte size, while we found that the SHG intensity of dermal collagen reduces considerably with increasing body weight. Obese mice on high-fat diet showed worse results than those on high-fat - high-fructose diet. Animals on high-fructose diet did not gain more weight than those on ordinary diet despite of the increased calorie intake, but their collagen damage was nonetheless significant. Obesity and high sugar intake damages the skin, mainly the dermal connective tissue and subcutaneous adipose tissue, which efficiently can be monitored by *in vivo* SHG and *ex vivo* CARS microscopy.

OCIS codes: (170.1870) Dermatology; (180.4315) Nonlinear microscopy.

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