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EXPRESSION OF UNCOUPLING PROTEIN IN SKELETAL MUSCLE AND WHITE FAT OF OBESE MICE TREATED WITH A THERMOGENIC β3-ADRENERGIC AGONIST

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Mitochondrial uncoupling protein (UCP) is usually expressed only in brown adipose tissue (BAT) and is a key molecule for metabolic thermogenesis. The effects of a highly selective β3-adrenergic agonist, CL316,243 (CL), on UCP expression in skeletal muscle and adipose tissues were examined in mice. Daily injection of CL (0.1 mg/kg, sc) into obese yellow KK mice for 2 weeks caused a significant reduction of body weight, associated with a marked decrease of white fat pad weight and hypertrophy in interscapular BAT with a 6-fold increase in UCP content. Clear signals of UCP protein and mRNA were detected by Western and Northern blot analyses in inguinal, mesenteric and retroperitoneal white fat pads, and also in gastrocnemius and quadriceps muscles, whereas there was no signal in saline-treated mice. The presence of UCP mRNA in the muscles was also confirmed by reverse transcription-PCR analysis. Weaker UCP signals were also detected in control C57BL mice treated with CL, but only in an inguinal fat pad. Immunohistochemical examinations revealed that UCP stains in the white fat pads were localized on multilocular cells quite similar to typical brown adipocytes, and those in the muscle tissues on myocytes. The mitochondrial localization of UCP in myocytes was confirmed by immunoelectron microscopy. Thus, chronic stimulation of the β3-adrenergic receptor induces ectopic expression of UCP in adipose tissues conventionally considered to be white fat and even in skeletal muscle, which probably contributes to the potent anti-obesity effect of the β3-adrenergic agonist.