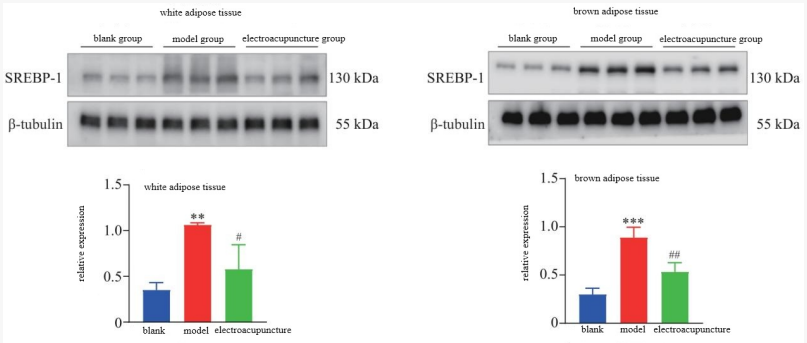
Turning white fat brown: How electroacupuncture reprograms obese metabolism

GA, UNITED STATES, May 12, 2026 /EINPresswire.com/ -- Obesity is characterized by excessive energy storage in white adipose tissue, whereas increasing energy expenditure through browning the white adipose tissue represents a promising therapeutic direction. New research demonstrates that electroacupuncture can shift fat metabolism by promoting the browning of white adipose tissue in obese animals. Using a diet-induced obesity model, the study shows that electroacupuncture reduces body weight and improves lipid profiles while restoring thermogenic capacity in adipose tissue. Mechanistically, the intervention activates the PKA/CREB signaling pathway, enhances expression of key thermogenic genes including UCP1 and PGC-1α, and suppresses lipid synthesis regulators. These findings reveal a biological basis for how electroacupuncture modulates energy metabolism and highlight its potential role in obesity intervention strategies.



Comparison of SREBP-1 protein expression of rats in the 3 groups (x□±s□3 rats/group).

Globally rising obesity rates pose major health risks, including type 2 diabetes, cardiovascular disease, and certain malignancies. Obesity is driven largely by the expansion and hypertrophy of white adipose tissue, which stores excess energy as triglycerides. In contrast, brown and beige adipose tissues dissipate energy through non-shivering thermogenesis, offering a metabolic counterbalance. Converting white fat into a brown-like, energy-consuming state—known as “browning”—has emerged as a promising anti-obesity approach. This process relies on coordinated activation of thermogenic genes such as UCP1, PGC-1α, and PRDM16. Given the therapeutic potential of adipose tissue browning, it is necessary to explore alternative, mechanistically grounded approaches to activate adipose tissue browning and improve metabolic health.

A research team from Chongqing Medical University reported (DOI: 10.13702/j.1000-0607.20240755) in May 2025 in Acupuncture Research that electroacupuncture significantly improves lipid metabolism and induces browning of white adipose tissue in obese rats. Using a

high-fat diet–induced obesity model, the researchers demonstrated that electroacupuncture reduces body weight, improves serum lipid profiles, and reverses pathological fat morphology. Importantly, the study identifies activation of the PKA/CREB signaling pathway as a central mechanism linking electroacupuncture to increased expression of thermogenic genes and metabolic remodeling in adipose tissue.

The study employed male rats with diet-induced obesity and administered electroacupuncture at "Zhongwan" (CV12), "Guanyuan" (CV4), and bilateral "Tianshu" (ST25) and "Fenglong" (ST40) for six weeks. Researchers assessed body composition, serum lipid parameters, adipose tissue histology, and molecular signaling responses. Compared with untreated obese animals, electroacupuncture markedly reduced body weight, abdominal circumference, and Lee's index, while lowering triglycerides, total cholesterol, and LDL cholesterol and increasing HDL cholesterol.

Histological analyses showed that electroacupuncture reversed obesity-associated adipocyte hypertrophy and restored normal morphology in both white and brown adipose tissue. At the molecular level, electroacupuncture significantly increased expression of thermogenic genes, including UCP1, PGC-1α, PRDM16, PPARγ, Cox7a1, Cox8b, DIO2, Cidea, ELOVL3, Tbx1, Tmem26, and CD137. Correspondingly, levels of UCP1 and PGC-1α protein were elevated in adipose tissue.

Mechanistic analyses revealed that obesity suppressed PKA activity and CREB phosphorylation, whereas electroacupuncture restored PKA/CREB signaling. This activation was accompanied by suppression of the lipid synthesis regulator SREBP-1, linking neuromodulation to coordinated shifts in energy storage and expenditure.

The authors emphasize that activating endogenous thermogenic pathways represents a biologically efficient strategy for obesity management. By demonstrating that electroacupuncture directly engages the PKA/CREB signaling axis, the study provides mechanistic clarity beyond descriptive metabolic outcomes. Rather than acting solely on body weight, electroacupuncture appears to reprogram adipose tissue toward an energy-consuming phenotype through coordinated regulation of thermogenic gene networks. These insights strengthen the scientific foundation for non-pharmacological interventions in metabolic disease research.

The findings suggest that electroacupuncture may represent a complementary strategy for obesity intervention by targeting adipose tissue plasticity rather than caloric intake alone. Identifying the PKA/CREB pathway as a key regulatory axis provides a molecular framework for optimizing treatment protocols and exploring combination strategies with lifestyle or pharmacological interventions. Although clinical validation is still required, this study supports the concept that neuromodulatory therapies can activate intrinsic thermogenic programs encoded by genes such as UCP1 and PGC-1α. Such approaches may broaden future options for precision metabolic health management.

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Lucy Wang
BioDesign Research
email us here