Ucp1-KO

Strain Name: C57BL/6JGpt-*Ucp1*^{em13Cd5701}/Gpt
Strain Type: Knockout
Strain ID: T037633
Background: C57BL/6JGpt

Description

Uncoupling proteins (UCP) are members of the mitochondrial anion carrier family, and five UCP homologs have been identified to date. UCP1, the first UCP identified member, is predominantly expressed in brown adipose tissue and responsible for nonshivering thermogenesis[1]. UCP1 uses the proton gradient across the mitochondrial inner membrane to generate heat by uncoupling oxidative phosphorylation from ATP production[2]. UCP1-mediated thermogenesis is important in maintaining body temperature in cold environments and during the postnatal period, as well as in regulating adiposity.

UCP1 activity is controlled by the sympathetic nervous system; physiological stimuli such as cold exposure and several kinds of stress activate sympathetic nerves that innervate BAT, which induces the activation of β-adrenergic receptor and downstream signaling pathway, ultimately activating UCP1 activity[3]. Cold exposure not only activates UCP1-mediated thermogenesis in BAT but also causes drastic changes in glucose, lipid, and amino acid metabolism.

Ucp1 KO mice have been shown to be non-obese upon high-fat diet challenge and extremely cold sensitive[4]. The *Ucp1*-KO mouse model was created at GemPharmatech and the endogenous mouse *Ucp1* gene was knock-out via CRISPR/Cas9 technology.

Strategy

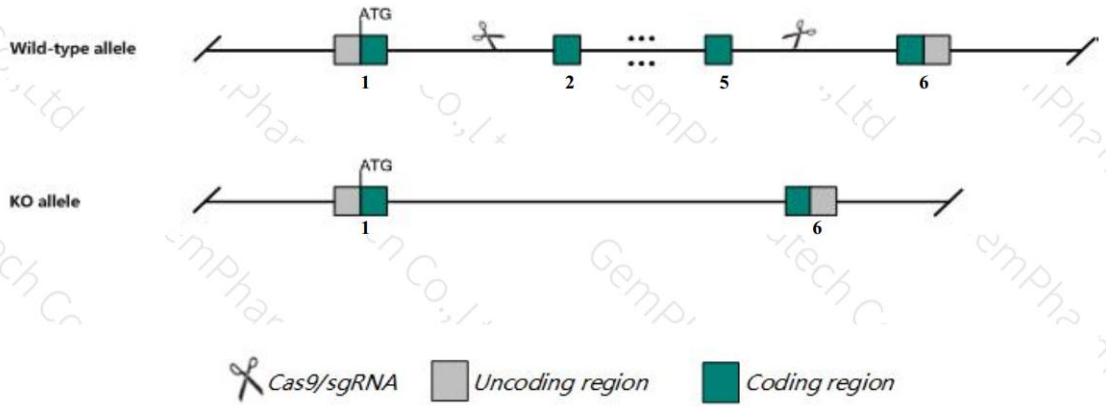

Fig 1. The *Ucp1*-KO mouse model strategy

Ucp1-KO mouse model was generated by using CRISPR/Cas9 technology to edit the *Ucp1* gene on the C57BL/6JGpt background.

Applications

1. UCP1-mediated thermogenesis in brown adipose tissue
2. Cold-induced metabolic changes
3. Obesity

Data support

1. Detection of Ucp1 expression

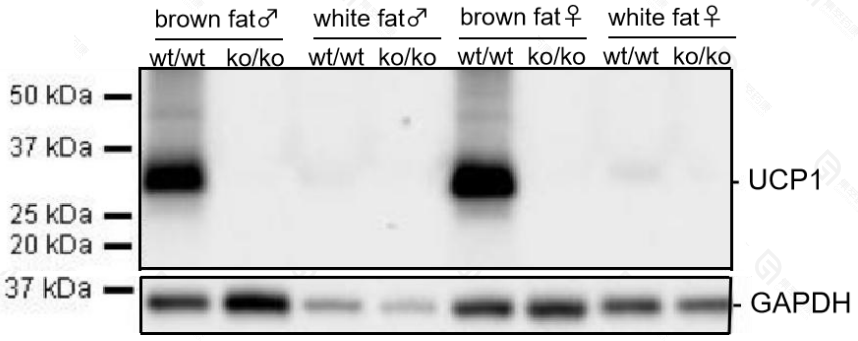

Fig 2. Detection of Ucp1 expression by Western Blot analysis

Brown fat tissue and white fat tissue were harvested from B6J wild-type, and *Ucp1*-KO homozygous mice and analyzed for Ucp1 expression by Western Blot analysis using specific antibody (Abcam, ab234430). Ucp1 protein was not expressed in white fat tissue and *Ucp1*-KO homozygous mice showed no expression of Ucp1 protein in brown fat tissue compared to that of wild-type control mice. (Data source: Abcam collaborative verification).

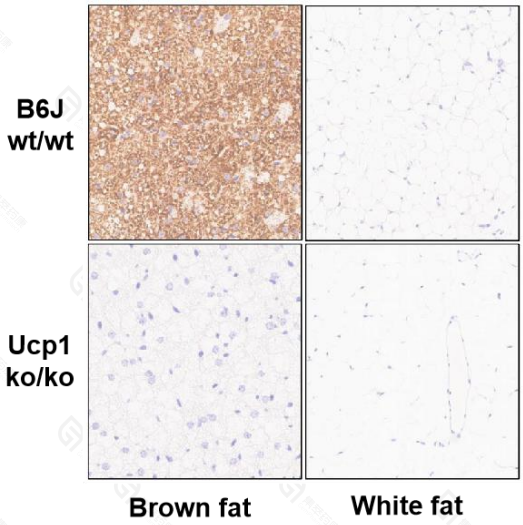

Fig 3. Detection of Ucp1 expression by Immunohistochemical analysis

Brown fat tissue and white fat tissue were harvested from B6J wild-type, and *Ucp1*-KO homozygous mice and analyzed for Ucp1 expression by Immunohistochemical analysis using specific antibody (Abcam, ab234430). Ucp1 protein was not expressed in white fat tissue and *Ucp1*-KO homozygous mice showed no expression of Ucp1 protein while B6J wild-type had positive staining on brown fat tissue. (Data source: Abcam collaborative verification).

References

1. Keipert S, Lutter D, Schroeder BO, *et al*. Endogenous FGF21-signaling controls paradoxical obesity resistance of UCP1-deficient mice. *Nat Commun*. 2020 Jan 31;11(1):624.
2. Kim K, Wann J, Kim HG, *et al.* Uncoupling protein 1-driven Cre (Ucp1-Cre) is expressed in the epithelial cells of mammary glands and various non-adipose tissues. *bioRxiv* [Preprint]. 2023 Oct 22:2023.10.19.563175.
3. Okamatsu-Ogura Y, Kuroda M, Tsutsumi R, *et al.* UCP1-dependent and UCP1-independent metabolic changes induced by acute cold exposure in brown adipose tissue of mice. *Metabolism*. 2020 Dec;113:154396.
4. Kang GS, Jo HJ, Lee YR, *et al.* Sensing the oxygen and temperature in the adipose tissues - who's sensing what? *Exp Mol Med*. 2023 Nov;55(11):2300-2307.