Data Article

Data on in vivo PGC-1alpha overexpression model via local transfection in aged mouse muscle

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\textbf{ABSTRACT}

The data presented in this article are related to the research paper entitled “Intensiﬁed mitophagy in skeletal muscle with aging is downregulated by PGC-1alpha overexpression in vivo” (Yeo et al., 2019). The data explained the surgical procedure of in vivo local transfection by electroporation method in aged mouse tibialis anterior muscle, and plasmid DNA preparation and veriﬁcation protocol. The data also showed the transfection efﬁciency levels of GFP or GFP-tagged PGC-1alpha through immunohistochemistry method for frozen muscle cross-sections.

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\textbf{Specifications table}

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Subject area & Biology \\
More specific subject area & Skeletal muscle in vivo transfection \\
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2352-3409/© 2018 Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).
How data were acquired

Fluorescence Microscope (Nikon Ti-S eclipse microscope with NIS-Elements 4.1.1 software)

Data format

Raw

Experimental factors

Fluorescence live cell imaging; C2C12 myoblast cells transfected with GFP-tagged plasmid DNA were cultured and imaged using microscope, immunohistochemistry; tibialis anterior (TA) muscle transfected with plasmid DNA was isolated, cross-sectioned, stained with appropriate antibodies and imaged using microscope.

Experimental features

Aged C57BL/6J mice were anesthetized and transfected with GFP-tagged plasmid DNA in TA muscle via electroporation. After 5 days, TA muscle were collected and prepared for immunohistochemistry.

Data source location

Laboratory of Physiological Hygiene and Exercise Science, School of Kinesiology, University of Minnesota Twin Cities, Minneapolis, MN 55455, United States of America

Data accessibility

Data are with this article

Related research article

Yeo D, Kang C, Gomez-Cabrera MC, Vina J, Ji LL. Intensi
difed mitophagy in skeletal muscle with aging is downregulated by PGC-1alpha overexpression in vivo, Free Radic Biol Med. 130, 2019, pp. 361–368 [1].

Value of the data

- The Establishment of an in vivo PGC-1alpha overexpression model of local muscle transfection using electroporation in aged mice indicates that this method can be applied to a wider range of possibilities to study aged mouse muscle.
- Providing the detailed experimental methodologies will help other researchers who want to develop their own model of muscle transfection.
- Valuable for researchers interested in the relationship between PGC-1alpha or other novel genes and sarcopenia.

1. Data

Here, we present data regarding PGC-1alpha in vivo transfection in aged mouse muscle [1]. The data demonstrated surgical procedures for in vivo transfection (Fig. 1); GFP or GFP-PGC-1α expression levels in C2C12 cell line for verifying plasmid DNA transfection efficiency (Fig. 2); and protein expression levels of GFP or GFP-PGC-1α in TA muscles, and the transfection efficiency in both young and old mice using immunohistochemistry (Fig. 3).

2. Experimental design, materials and methods

2.1. Animals and experimental group

Young (age 8–10 weeks) and old (age 24 month) female C57BL/6J mice were randomly divided into the following four groups: 1) GFP transfection in young (Y-GFP, n = 7); 2) PGC-1 transfection in young (Y-OE, n = 7); 3) GFP transfection in old (O-GFP, n = 7); 4) PGC-1 transfection in old (O-OE, n = 7). All surgical procedures and experiments protocol on mice were approved by Research Animal Resource Center at the University of Minnesota Twin Cities.
2.2. Plasmid DNA preparation and verification

GFP-tagged PGC-1α plasmid was kindly provided from Dr. Bruce M. Spiegelman (Plasmid #4; Addgene, USA). Cloning of this plasmid DNA was performed via transformation with DH5α competent cells (Invitrogen, USA) following manufacturer’s instruction. Extracting plasmid DNA from E. coli was carried out by plasmid megaprep kit (Qiagen, USA). Diagnostic restriction enzyme digest was carried out by using BamHI and Sall restriction enzymes (Invitrogen), respectively. Agarose gel electrophoresis was performed to confirm the plasmid fragments size after restriction enzyme digestion. Testing the plasmid DNA transfection efficiency was performed on C2C12 cell line using Lipofectamine™ 2000 transfection reagent (Invitrogen). Visualization of the transfected plasmid DNA was carried out via using fluorescence Microscope equipped with GFP or FITC filters (Fig. 2).
2.3. in vivo plasmid DNA transfection

in vivo plasmid DNA transfection was carried out as previously described [2]. For anesthetizing a mouse, ketamine-xylazine cocktail (0.1 mL/20 g body weight) was administered by intraperitoneal injection, and a small incision was made through the skin where it covers the TA muscle. Injection of plasmid DNA (2.5 μg/μl GFP or 2.7 μg/μl GFP-PGC-1α) with 27-gauge insulin syringe was applied into the proximal (6 μL) and distal (6 μL) ends of the muscle belly. Electroporation was administered by two stainless steel pin electrodes (1 cm gap, BTX-Harvard Apparatus, USA) laid on top of the proximal and distal myotendinous junctions. Electric pulses were delivered with an ECM 830 electroporation unit (10 kV/cm^2 20 ms square wave length, 1 Hz frequency with 180 V/cm field strength, BTX-Harvard Apparatus). Then, the incision was closed with Vetbond surgical glue (3M, USA).

2.4. Frozen muscle cryosectioning and immunohistochemistry

Frozen TA muscle cross-sectioning and immunohistochemistry analysis were performed as previously described [3]. Briefly, 4% paraformaldehyde fixation and sucrose cryopreservation procedures applied to 5 days transfected TA muscle. Embed the TA muscle in Tissue-Tek OCT compound (Sakura Finetek, USA) and immediately freeze it with liquid nitrogen chilled isopentane. Cross sections (12 mm in thickness) from the mid-belly of the muscle. Sections were then washed in DPBS for 15 min followed by 20 min incubation in blocking solution (DPBS containing 0.5% bovine serum albumin and 0.5% Triton X-100). Sections were incubated with anti-laminin primary antibody (ab11575, Abcam, UK) and then incubated with Alexa Fluor 594 antibody which stained the muscle cell outer membrane. Visualize muscle sections using a fluorescence microscope with Texas Red and FITC filters.
Transparency document. Supporting information

Transparency document associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2018.12.032.

References

[1] D. Yeo, C. Kang, M.C. Gomez-Cabrera, J. Vina, L.L. Ji, Intensified mitophagy in skeletal muscle with aging is downregulated by PGC-1alpha overexpression in vivo, Free Radic. Biol. Med. 130 (2019) 361–368.
[2] C. Kang, L.L. Ji, PGC-1α overexpression via local transfection attenuates mitophagy pathway in muscle disuse atrophy, Free Radic. Biol. Med. 93 (2016) 32–40.
[3] C. Kang, C.A. Goodman, T.A. Hornberger, L.L. Ji, PGC-1α overexpression by in vivo transfection attenuates mitochondrial deterioration of skeletal muscle caused by immobilization, FASEB J. 29 (2015) 4092–4106.