Nutrition Metaboli

RESEARCH Open ess

AMP-activated protein kinase is required fo anti-adipogenic effects of alpha-linolenic

Xihong Zhou, Weiche Wu, Jingqing Chen, Xinxia Wang and Yizhen Wang*

Abstract

Background: n-3 long chain polyunsaturated fatty acid (n-3 LC PUFA) increase accumulation in adipocytes. The current study was conducted to determine whe acid (ALA) could also exert the above effects and how AMP-activated protein k

Methods: AMPKα1$^{-/-}$, AMPKα2$^{-/-}$ mice and wild-type (WT) mice were fed a ody weight was recorded weekly and serum was collected. Adipocytes size an mitochondrial biogenesis and lipid oxidation were also measured.

Results: Our results showed an elevated serum adiponectin level and e fed HFD with ALA when compared with WT mice fed HFD. In addi and adipocytes size in WT mice. At protein level, mitochondrial gamma coactivator 1 alpha [PGC1α] and nuclear respiratory fa ne palmitoyltransferase 1A [CPT1a] and peroxisome proliferator- ated by dietary ALA in epididymal fat of WT mice. Consistently, die ic DNA copy numbers. Moreover, lipogenesis was repressed by dietar acid synthase (FAS), acetyl CoA carboxylase (ACC) and stearoyl-CoA desatu hese aforementioned effects were abolished in the AMPKα1 and AMPKα2

Conclusions: Our results suggest that ALA could its anti-adipogenic effects are dependent on AMPK.

Keywords: Alpha-linolenic acid, AMP-activa , Mitochondrial biogenesis, Adipose tissue

Introduction

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Materials and methods

Animals and diets

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Measurement of AMPK activity

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DNA content in adipose tissue and Mitochondrial (mt) DNA analysis

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Statistical analysis

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Results

Effects of ALA on serum insulin, adiponectin and leptin concentration in WT, AMPKα1$^{-/-}$ and AMPKα2$^{-/-}$ mice

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Effects of ALA on HFD-induced fat deposition in white adipose tissue required AMPK

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Table 2 Effects of ALA on fat depots of WT, AMPK**α**1$^{-/-}$ and AMPK**α**2$^{-/-}$ mice fed HFD

	WT		**AMPKα1$^{-/-}$**		**AMPKα2$^{-/-}$**	
	HF	**HF-A**	**HF**	**HF-A**	**HF**	**HF-A**
Final BW (g)	42.6 ± 3.1	32.6 ± 1.8^{ab}	43.1 ± 3.0	42 ± 3.2	45.5 ± 3.4	44.2 ± 3.7
Epididymal						
weight (mg)	2270 ± 158	1224 ± 98^{ab}	2242 ± 201	2137 ± 198	2349 ± 178	2146 ± 184
DNA (μg/mg)	0.32 ± 0.04	0.67 ± 0.05^{ab}	0.29 ± 0.05	0.35 ± 0.06	0.29 ± 0.05	0.36 ± 0.07
Inguinal						
Weight (mg)	1090 ± 42	1037 ± 57	1097 ± 45	1058 ± 55	1102 ± 49	1072 ± 59
DNA (μg/mg)	0.42 ± 0.05	0.5 ± 0.06	0.36 ± 0.04	0.39 ± 0.06	0.38 ± 0.05	0.41 ± 0.07

Note: The values are means ± SE. ^{a}P < 0.05 for difference between different genotypes with HF-A diet; ^{b}P < 0.05 for difference between WT mice. BW, body weight. HF, mice fed high-fat diet; HF-A, mice fed high-fat diet with ALA.

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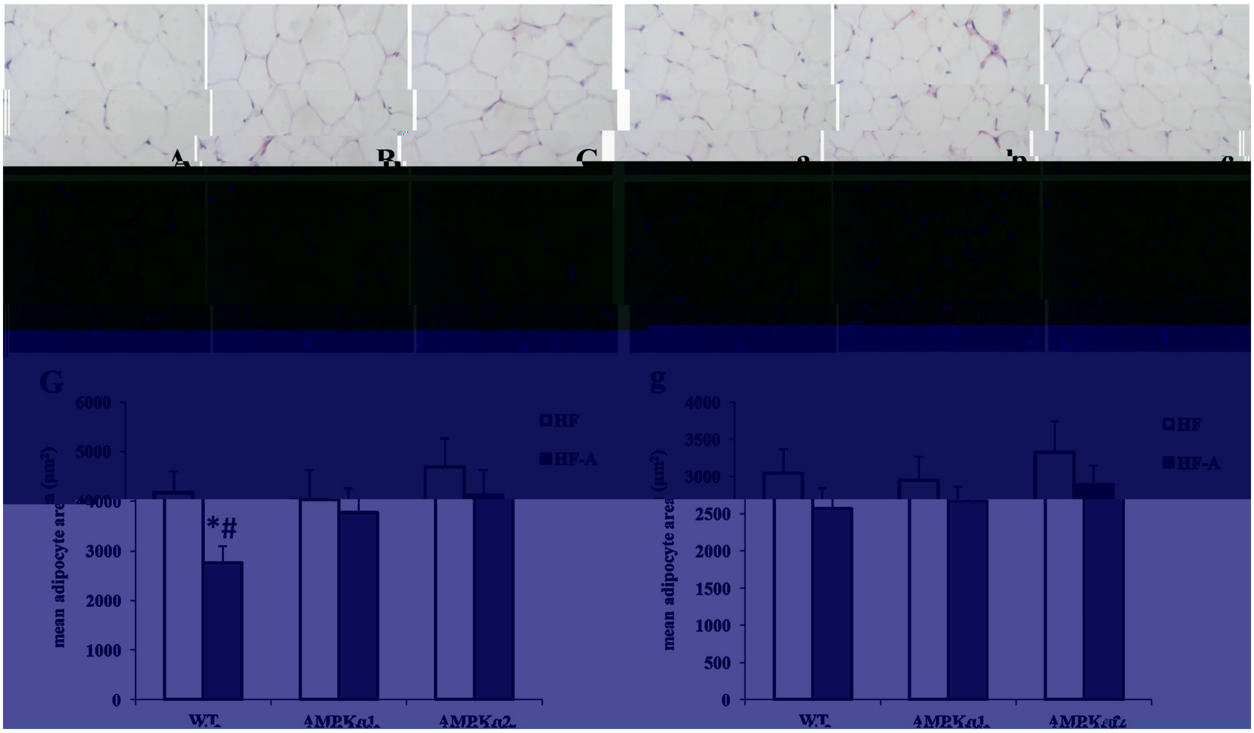

Figure 1 **Adipocyte size in WT, AMPKα1$^{-/-}$ and AMPKα2$^{-/-}$ mice. A**, **a**, WT mice fed HF diet; **B**, **b**, AMPKα1$^{-/-}$ mice fed HF diet; **C**, **c**, AMPKα2$^{-/-}$ mice fed HF diet; **D**, **d**, WT mice fed HF-A diet; **E**, **e**, AMPKα1$^{-/-}$ mice fed HF-A diet; **F**, **f**, AMPKα2$^{-/-}$ mice fed HF-A diet; **G**, **g**, mean adipocyte area in WT mice, AMPKα1$^{-/-}$ and AMPKα2$^{-/-}$ mice (uppercase represents epididymal fat; lowercase represents inguinal fat; cell size, μm^2); HF, mice fed high-fat diet; HF-A, mice fed high-fat diet with ALA.

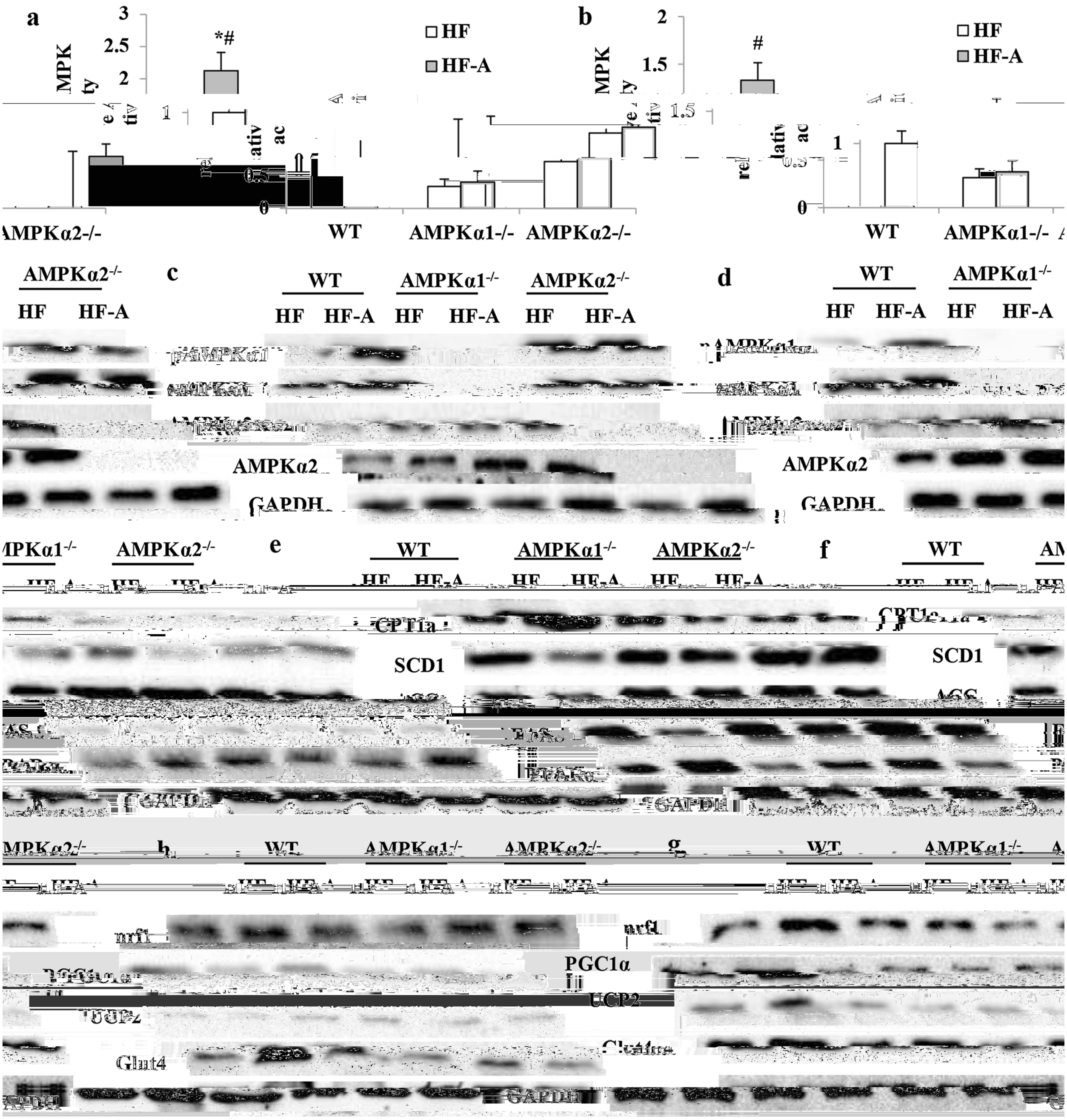

Figure 2 **AMPK activity, protein expression of mitochondrial biogenesis and β-oxidation related genes in WT, AMPKα1$^{-/-}$ and AMPKα2$^{-/-}$ mice.** HF, mice fed high-fat diet; HF-A, mice fed high-fat diet with ALA. (**a**, **c**, **e**, **g**, activity of AMPK and protein expressed in epididymal fat; **b**, **d**, **f**, **h**, activity of AMPK and protein expressed in inguinal fat). The values are means ± SE. #P < 0.05 for difference between different genotypes with HF-A diet; *P < 0.05 for difference between WT mice.

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carried out the experiments and collected the data; WYZ participated in its design and coordination and helped to draft the manuscript. All authors read and approved the final manuscript.

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