

Betaine alleviates hepatic lipid accumulation via enhancing hepatic lipid export and fatty acid oxidation in rats fed with a high-fat diet

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Key Laboratory of Molecular Animal Nutrition, Ministry of Education, College of Animal Sciences, Zhejiang University, Hangzhou 310029, People's Republic of China

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Abstract

Abstract

100 50 250

($P < 0.05$)

($P < 0.05$)

($P < 0.05$)

expressions of hepatic broblast growth factor 21 (FGF21) are increased

($P < 0.05$)

Key words:

(N,N',N'-)

(12)

In vivo,

(3)

(11)

(12,13)

(1,1)

Materials and methods

Animal experimental procedure

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[illegible]

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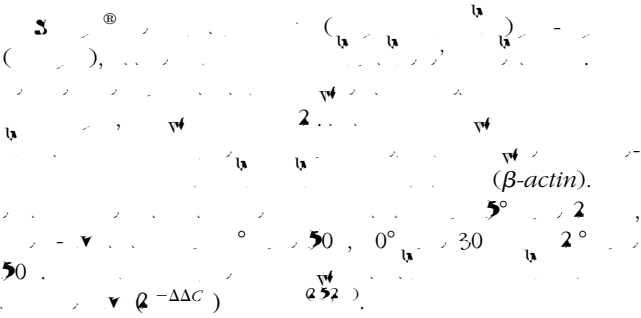
Sampling

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad \text{and} \quad \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}.$$

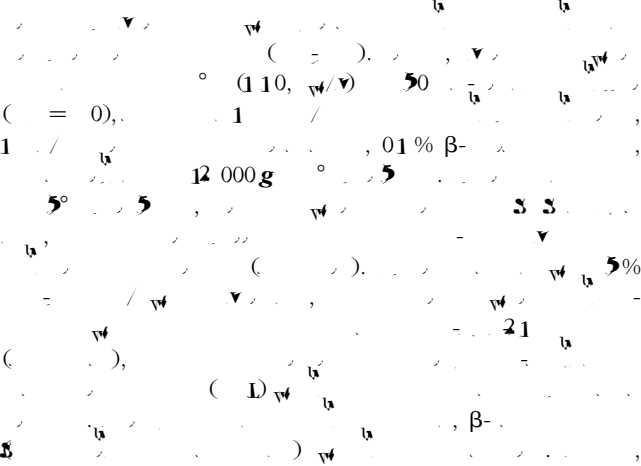
Table 2. Primer-pairs of target genes used for real-time PCR

Gene	Forward primer (from 5' to 3') Reverse primer (from 5' to 3')	PCR product size (bp)	GenBank accession number
<i>β-Actin</i>	GGA AAT CGT GCG TGA CAT TA AGG AAG GAA GGC TGG AAG GAG	183	NM_031144
<i>BHMT</i>	GGGCAGAAGGTCAATGAAGCT ACCAATGCATCCCCTTCGT	108	NM_030850
<i>PPARα</i>	TGCGGACTACCACTACTTAG CGACACTCGATGTTTCAGTGC	167	M88592
<i>FGF21</i>	CGACAGAGGTATCTCTACACAGATGACG GATCCATAGAGAGTTCCATCTGGTTGTT	206	NM_130752
<i>AMPK</i>	TGTGACAAGCACATTTTCCAA CCGATCTCTGTGGAGTAGCAG	156	NM_019142-2
<i>CPT1</i>	GCTCGCACATTACAAGGACAT TGGACACCACATAGAGGCAG	250	AF020776

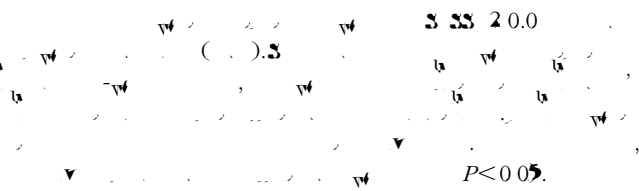
BHMT, betaine-homocysteine methyltransferase; *FGF21*, fibroblast growth factor 21; *AMPK*, AMP-activated protein kinase; *CPT1*, carnitine palmitoyltransferase 1.



Western blot analysis

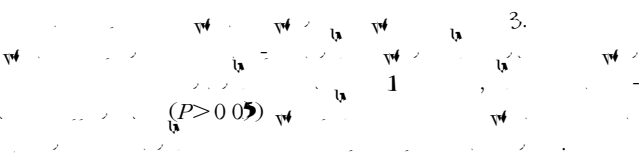


Statistical analysis



Results

Assessment of body weight



Effects of betaine on serum lipid metabolites

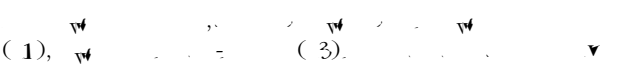


Table 3. Changes of body weight during 4 weeks (g)
(Mean values and standard deviations, *n* 7)

	T1		T2		T3		T4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
0 d	100.02	0.15	100.15	0.28	99.91	0.13	99.95	0.36
7 d	150.00	2.58	148.75	3.14	152.12	3.46	149.12	3.03
14 d	202.00	5.42	205.5	6.75	207.75	7.45	206.17	7.60
21 d	228.74	16.83	244.13	17.55	227.61	26.12	253.83	31.47
28 d	290.58	9.86	296.03	14.26	287.26	15.80	305.75	25.67

T1, basal diet; T2, basal diet with betaine administration; T3, high-fat diet; T4, high-fat diet with betaine administration.

21. (), (3) (P<0.05)
 AMPK (5()).
 (P<0.05) AMPK.
 AMPK (3). (1)

Discussion

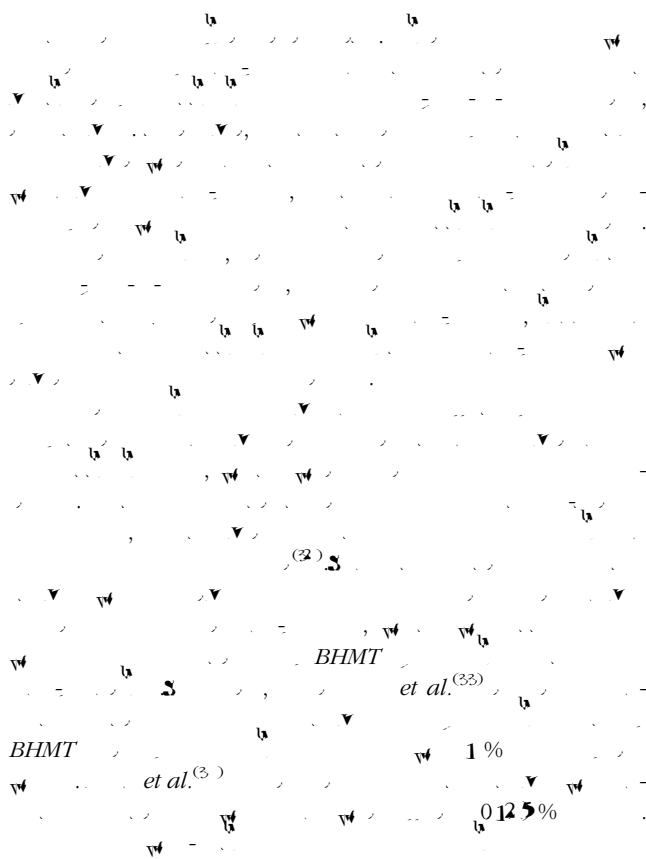
21. (12 2)
 (30)
 (31)

Betaine increased the activity, gene and protein expression of fibroblast growth factor 21, and elevated the gene expression of AMP-activated protein kinase in the liver

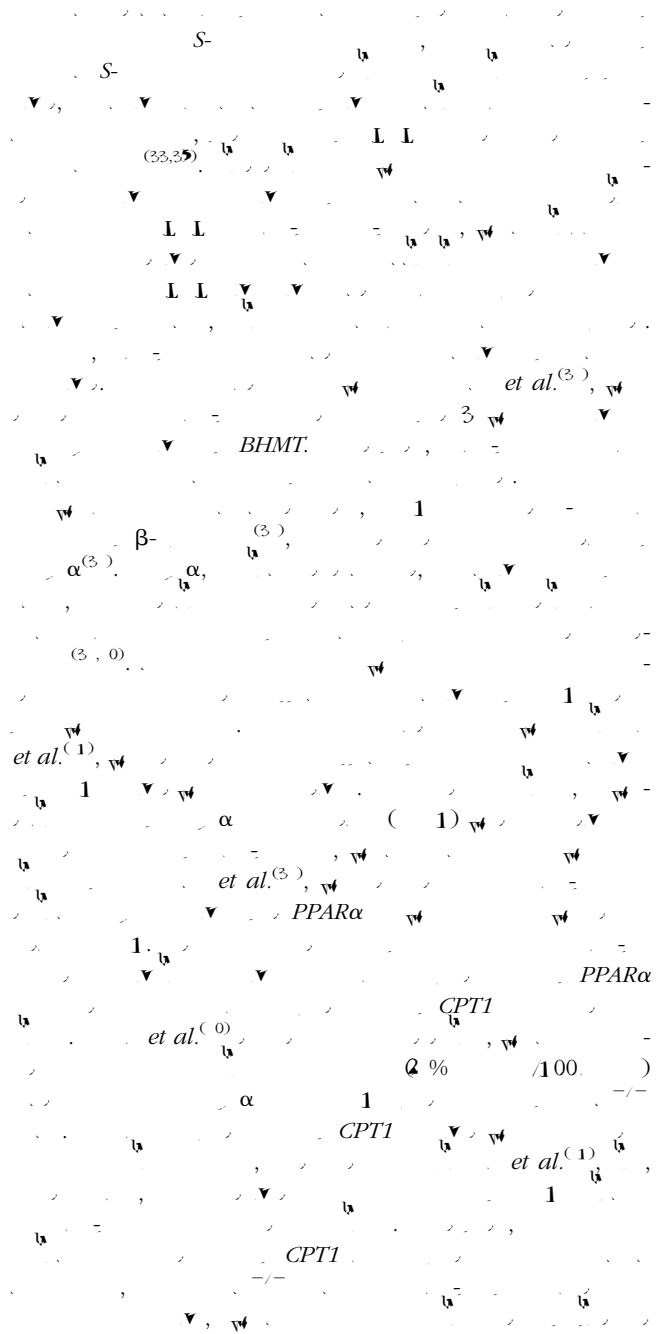
21. (1), (3) (P<0.05)
 FGF21. (P<0.05)
 21 (1)
 (3), (P<0.05)

Table 5. Effects of betaine on hepatic lipid metabolism
 (Mean values and standard deviations, *n* 7)

	T1		T2		T3		T4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
TAG (mg/g)	7.81 ^b	0.66	7.47 ^b	0.58	9.20 ^a	1.42	7.96 ^b	0.84
NEFA (μmol/g protein)	32.73 ^b	9.16	39.44 ^b	11.77	57.93 ^a	12.76	67.08 ^a	12.27
TC (mg/g)	2.21 ^{b,c}	0.17	2.46 ^{a,c}	0.47	2.58 ^{a,c}	0.48	2.76 ^a	0.49
Lecithin (ng/g)	1.00 ^c	0.05	1.10 ^b	0.05	1.04 ^c	0.05	1.17 ^a	0.02
14.6/aLecithinepatic1anmol/gVLDL prc								



(A) 3.5
3.0
2.5



(B)

(C)

et al.⁽⁵⁰⁾

Acknowledgements

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