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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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Abstract

(P<) (P<) P< (P<)

Expressions of hepatic broblast growth factor 21 (FGF21) ere increased

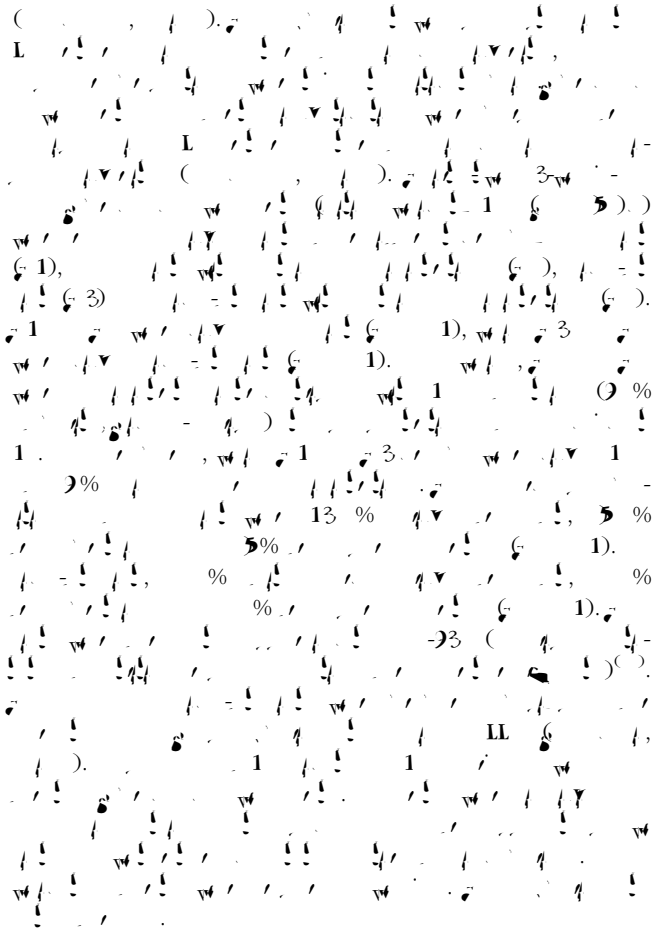
Key words:

(*N*,*N*,*N*-

In vivo,

Materials and methods

Animal experimental procedure



Sampling

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
β-Actin	GGA AAT CGT GCG TGA CAT TA AGG AAG GAA GGC TGG AAG GAG	183	NM_031144
BHMT	GGGCAGAAGGTCAATGAAGCT ACCAATGCATCCCCTTCGT	108	NM_030850
PPARα	TGCGGACTACCAGTACTTAG CGACACTCGATGTTCAGTGC	167	M88592
FGF21	CGACAGAGGTATCTCTACACAGATGACG GATCCATAGAGAGTTCCATCTGGTTGTT	206	NM_130752
AMPK	TGTGACAAGCACATTTTCCAA CCGATCTCTGTGGAGTAGCAG	156	NM_019142·2
CPT1	GCTCGCACATTACAAGGACAT TGGACACCACATAGAGGCAG	250	AF020776

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

(*β-actin*).

Western blot analysis

Statistical analysis

Results

Assessment of body weight

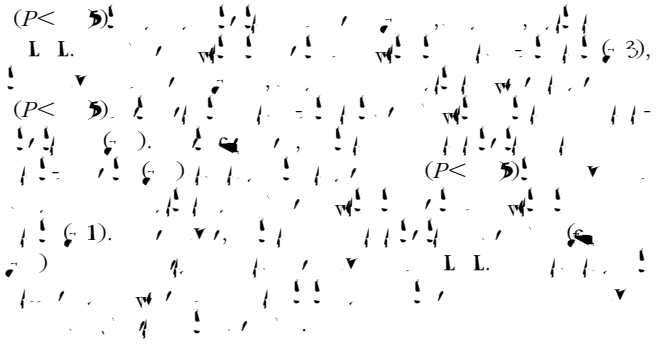
Effects of betaine on serum lipid metabolites

Table 3. Changes of body weight during 4 weeks (g)

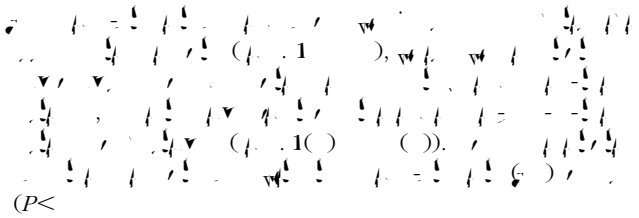
(Mean values and standard deviations, *n* 7)

	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.



Oral administration of betaine effectively alleviated the excessive accumulation of fat in the liver



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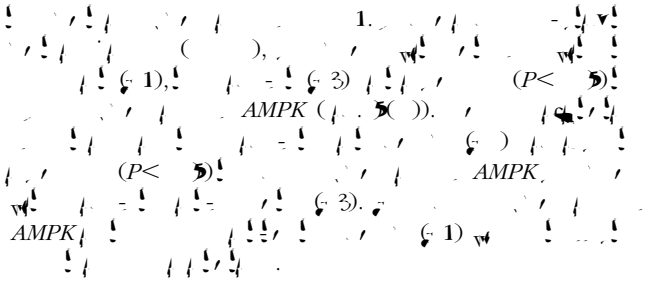
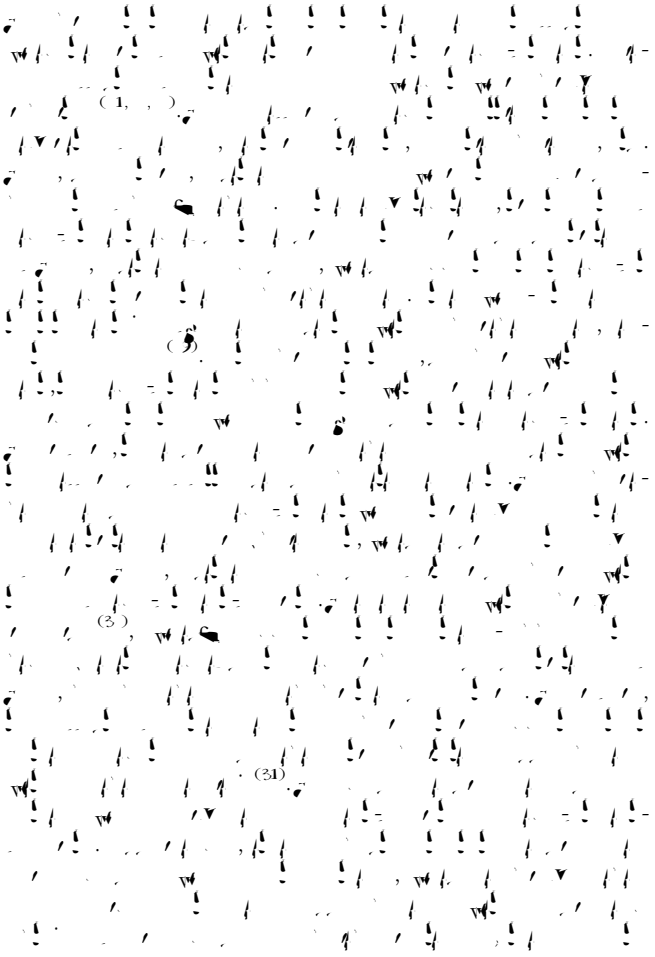
ologcall-42762(sertions)-246.1(ftaining)-244.9(with)-244.94Oil-Red-O--244.2(bere)-446.3(tonc)-1268(hmd)-546.31byoimage-245.2(sanaly



Discussion



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

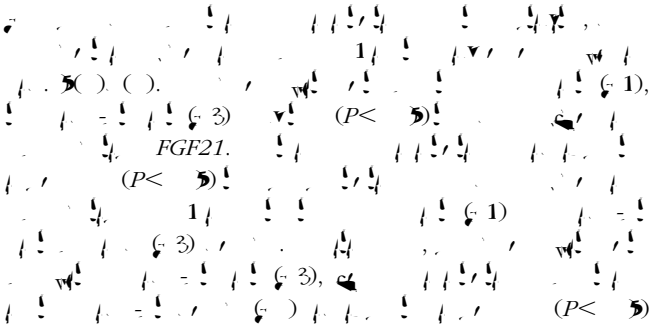
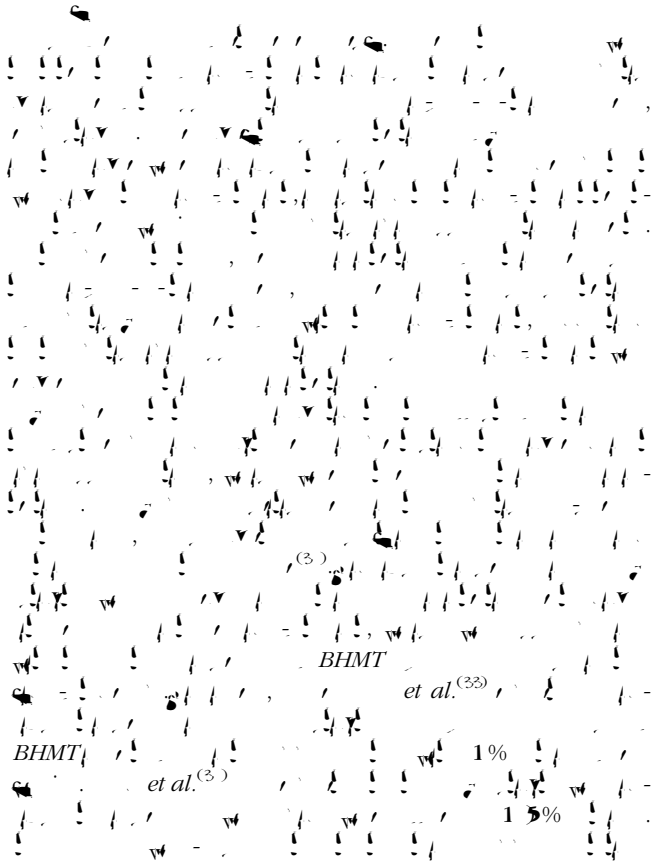
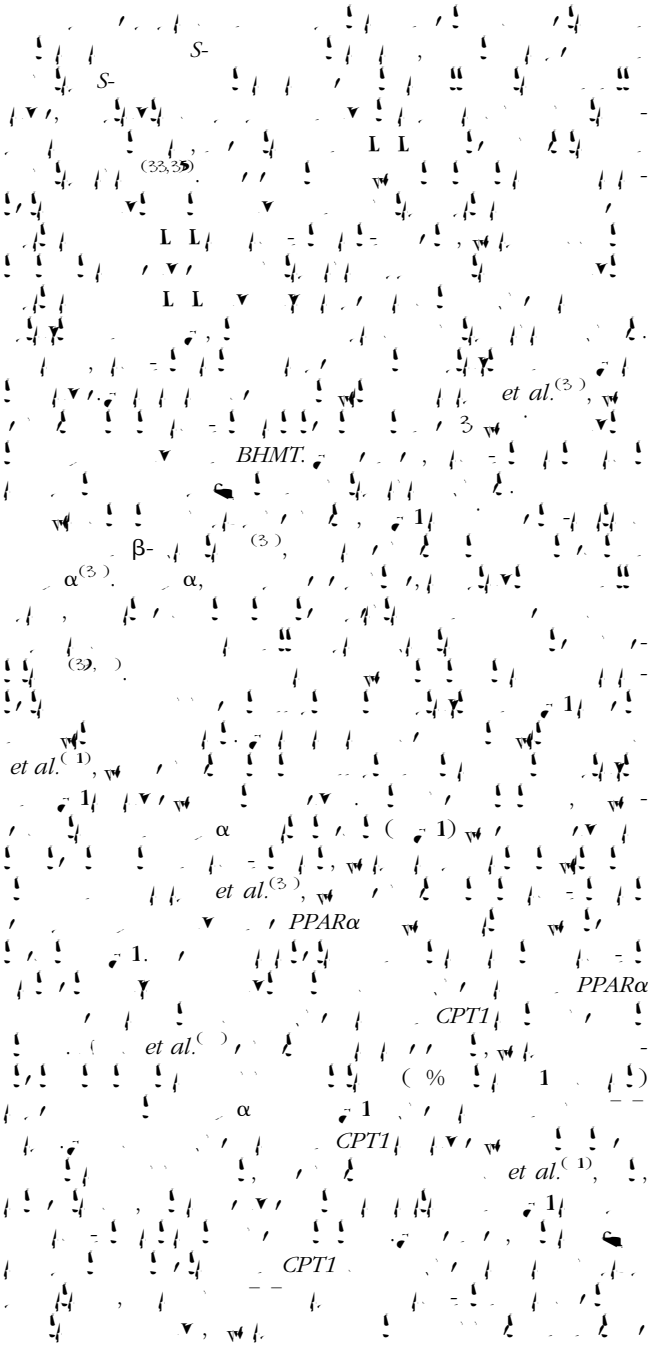


Table 5. Effects of betaine on hepatic lipid metabolism
(Mean values and standard deviations, *n* 7)

	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

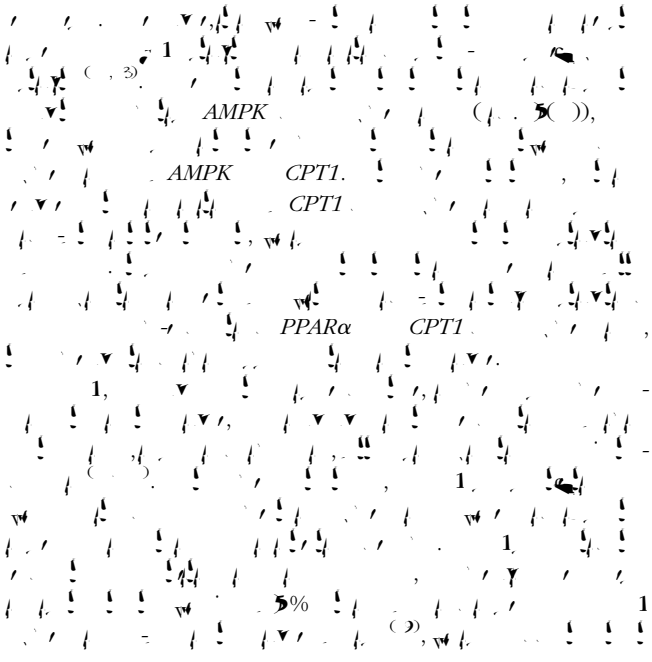


(A)



(B)

(C)



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