

Supporting information

Supplemental tables

Table S1 The ingredients of the experimental diets (g/100 g of diet)

Ingredients	ND	HFD	MRD
L-arginine	1.12	1.12	1.12
L-histidine-HCl-H ₂ O	0.33	0.33	0.33
L-isoleucine	0.82	0.82	0.82
L-leucine	1.11	1.11	1.11
L-lysine	1.44	1.44	1.44
L-methionine ¹	0.86	0.86	0.17
L-phenylalanine	1.16	1.16	1.16
L-threonine	0.82	0.82	0.82
L-tryptophan	0.18	0.18	0.18
L-valine	0.82	0.82	0.82
L-glutamic acid ¹	2.70	2.70	3.39
L-glycine	2.33	2.33	2.33
Corn starch	47.25	31.25	31.25
Maltodextrin	5.00	5.00	5.00
Dextrose	20.00	20.00	20.00
Cellulose	5.00	5.00	5.00
Lard	4.00	20.00	20.00
Mineral mix ²	3.50	3.50	3.50

Vitamin mix ²	1.00	1.00	1.00
Choline bitartrate	0.20	0.20	0.20

¹When the methionine content in the diet was decreased, the glutamic acid content was increased on an equal mass.

²Mineral mix and Vitamin mix were prepared based on the AIN-93 diet.

Table S2 Sequences of primers used in quantitative real-time reverse transcription PCR

Gene symbol	Forward primer (5'–3')	Reverse primer (5'–3')
LBP	CCCAGACGCTGGATGTGATG	TGATCTGAGATGGCAAAGTAGAC C
CD14	CTCTGTCCTTAAAGCGGCTTAC	GTTGCGGAGGTTCAAGATGTT
TLR4	CAGCAGGTCGAATTGTATCGCC	CCCTGTGAGGTCGTTGAGGTTAG
MyD88	TCATGTTCTCCATACCCTTGGT	AAACTGCGAGTGGGGTCAG
NF-κB	AGCTTATGCCGAACCTCTCG	TGACCCCTGCGTTGGATT
TNF-α	CTGAACTTCGGGGTGATCGGT	TCCTCCACTTGGTGGTTTGCTAC
IL-6	ACACACTGGTTCTGAGGGAC	TACCACAAGGTTGGCAGGTG
Claudin-3	ACCAACTGCGTACAAGACGAG	CAGAGCCGCCAACAGGAAA
ZO-1	ACCCGAAACTGATGCTGTGGATA G	AAATGGCCGGGCAGAACTTGTGT A
Occludin	ATGTCCGGCCGATGCTCTC	TTTGGCTGCTCTTGGGTCTGTAT
β-actin	GGGTCAGAAGGACTCCTATG	GTAACAATGCCATGTTCAAT

LBP, lipopolysaccharides-binding protein; CD14, cluster of differentiation 14; TLR4, toll-like

receptor 4; MyD88, myeloid differentiation factor 88; NF- κ B, nuclear factor- κ B; TNF- α , tumor necrosis factor- α ; IL-6, interleukin-6; ZO-1, zonula occludens-1.

Table S3 ^1H chemical shift assignment of the metabolites in the extract of colonic contents

Keys	Metabolites	Moieties	$\delta^1\text{H}$ (ppm) and multiplicity
1	taurocholic acid	CH_3	0.68(s)
2	bile acids	CH_3	0.73(m)
3	butyrate	CH_3 , βCH_2 , αCH_2	0.90(t), 1.56(m), 2.15(t)
4	α -ketoisocaproate	2* CH_3 , CH, CH_2	0.92(d), 2.06(m), 2.62(d)
5	isoleucine	δCH_3 , γCH_3 , γCH_2 , βCH_3 , βCH , αCH ,	0.94(t), 1.01(d), 1.25(m), 1.48(m), 1.98(m), 3.67(d)
6	leucine	δCH_3 , δCH_3 , γCH , βCH_2 , αCH	0.96(d), 0.97(d), 1.69(m), 1.71(m), 3.74(t)
7	valine	γCH_3 , γCH_3 , βCH , αCH	0.99(d), 1.04(d), 2.27(m), 3.62(d)
8	propionate	CH_3 , CH_2	1.06(t), 2.19(q)
9	α -keto- β -methyl- valerate	δCH_3 , $\gamma'\text{CH}_3$, γCH , $\gamma'\text{CH}$, βCH	0.88(t), 1.10(d), 1.47(m), 1.69(m), 2.93(m)
10	α -ketoisovalerate	CH_3 , CH	1.13(d), 3.02(m)
11	ethanol	CH_2 , CH_3	1.18(t), 3.66(q)
12	methylmalonate	CH_3 , CH_2	1.25(d), 3.18(q)
13	lactate	αCH , βCH_3	1.33(d), 4.11(q)
14	alanine	βCH_3 , αCH	1.48(d), 3.79(q)
15	citrulline	γCH_2 , βCH_2 , δCH_2 , αCH	1.56(m), 1.87(m), 3.15(t), 3.75(t)

16	arginine	γCH_2 , βCH_2 , δCH_2 , αCH	1.73(m), 1.93(m), 3.23(t), 3.75(t)
17	lysine	γCH_2 , δCH_2 , βCH_2 , ϵCH_2 , αCH	1.48(m), 1.73(m), 1.89(m), 3.03(t), 3.77(t)
18	acetate	CH_3	1.92(s)
19	proline	γCH_2 , βCH_2 , $\beta'\text{CH}_2$, δCH_2 , $\delta'\text{CH}_2$, αCH	2.01(m), 2.07(m), 2.36(m), 3.34(m), 3.45(m), 4.31(m)
20	N-acety-glycoprotein	CH_3	2.05(s)
21	glutamate	βCH_2 , $\beta'\text{CH}_2$, γCH_2 , αCH	2.10(m), 2.09(m), 2.36(m), 3.77(m)
22	methionine	δCH_3 , βCH_2 , γCH_2 , αCH	2.14(s), 2.16(m), 2.65(t), 3.86(m)
23	5-aminovalerate	2CH_2 , 3CH_2 , 1CH_2 , 4CH_2	1.62(m), 1.65(m), 2.24(t), 3.02(t)
24	pyruvate	CH_3	2.38(s)
25	succinate	CH_2	2.41(s)
26	glutamine	βCH_2 , γCH_2 , αCH	2.10(m), 2.45(m), 3.77(m)
27	aspartate	βCH_2 , $\beta'\text{CH}_2$, αCH	2.69(m), 2.83(m), 3.91(m)
28	dimethylamine	CH_3	2.76(s)
29	methylamine	CH_3	2.61(s)
30	threonine	γCH_3 , αCH , βCH	1.33(d), 3.59(d), 4.26(m)
31	trimethylamine	$3*\text{CH}_3$	2.88(s)
32	creatine	CH_3 , CH_2	3.04(s), 3.93(s)
33	malonate	CH_2	3.11(s)
34	choline	$\text{N}(\text{CH}_3)_3$, NCH_2 , OCH_2	3.21(s), 3.52(m), 4.07(m)
35	taurine	CH_2SO_3 , NCH_2	3.26(t), 3.43(t)

36	methanol	CH ₃	3.37(s)
37	glycine	CH ₂	3.57(s)
38	dimethylglycine	CH ₃ , CH ₂	2.92(s), 3.71(s)
39	malate	βCH ₂ , β'CH ₂ , αCH	2.38(dd), 2.70(dd), 4.31(dd)
40	1,3-dihydroxyacetone	CH ₃	4.42(s)
41	α-ketoglutarate	γCH ₂ , βCH ₂	2.45(t), 3.01(t)
42	β-arabinose	2CH, 3CH, 4CH, 5'CH ₂ , 1CH	3.52(dd), 3.67(t), 3.95(m), 3.86(dd), 4.50(d)
43	β-xylose	1CH, 2CH, 3CH	4.56(d), 3.24(dd), 3.47(t)
44	β-galactose	2CH, 3CH, 4CH, 5CH, CH ₂ , 1CH	3.48(dd), 3.65(dd), 3.93(m), 3.71(m), 3.74(m), 4.59(d)
45	β-glucose	1CH, 2CH, 3CH, 4CH, 5CH, 6CH	4.66(d), 3.25(dd), 3.49(t), 3.41(dd), 3.46(m), 3.73(dd), 3.90(dd)
46	α-xylose	1CH, 2CH, 3CH	5.19(d), 3.53(dd), 3.68(m)
47	α-glucose	1CH, 2CH, 3CH, 4CH, 5CH, 6CH	5.22(d), 3.54(dd), 3.71(dd), 3.42(dd), 3.84(m), 3.78(m)
48	α-arabinose	2CH, 3CH, 4CH, 5'CH ₂ , 1CH	3.85(dd), 3.99(t), 3.90(m), 4.02(dd), 5.24(d)
49	α-galactose	2CH, 3CH, 4CH, 5CH, 1CH, CH ₂	3.81(dd), 3.85(dd), 3.99(m), 4.09(m), 5.27(d), 3.74(m)
50	α-ribose	1CH, 2CH, CH ₂	5.39(d), 4.12(dd), 3.73(dd)
51	uracil	CH, CH	5.81(d), 7.54(d)

52	fumarate	CH	6.53(s)
53	4-hydroxyphenylactate	3, 5 CH, 2, 6 CH	6.86(d), 7.16(d)
54	tyrosine	β CH ₂ , β' CH ₂ , α CH, 3 or 5CH, 2 or 6CH	3.06(dd), 3.15(dd), 3.94(dd), 6.90(d), 7.19(d)
55	histidine	β CH ₂ , β' CH ₂ , α CH, 5CH, 3CH	3.14(dd), 3.25(dd), 3.99(dd), 7.09(s), 7.84(s)
56	tryptophan	β CH ₂ , β' CH ₂ , α CH, 5CH, 6CH, 2CH, 7CH, 4CH	3.31(dd), 3.49(dd), 4.06(dd), 7.21(t), 7.27(t), 7.30(s), 7.55(d), 7.73(d)
57	phenylalanine	β CH ₂ , β' CH ₂ , α CH, 2 or 6CH, 4CH, 3 or 5CH	3.13(dd), 3.29(dd), 3.98(dd), 7.33(m), 7.38(m), 7.43(m)
58	urocanate	CHCOOH, CH, 5CH, 3CH	6.40(d), 7.31(d), 7.43(s), 7.86(s)
59	xanthine	CH	7.89(s)
60	Hypoxanthine	N-CH, CH	8.19(s), 8.22(s)
61	formate	CH	8.45(s)
62	niacin	2CH, 6CH	8.93(s), 8.61(s)

s, singlet; d, doublet; t, triplet; q, quartet; dd, doublet of doublets; m, multiplet.