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## Supporting Information

2 **Table S1.** Composition of Chow, HFD, and EU group diet

	Chow (3.42 Kcal/g)	HFD (4.6 Kcal/g)	EU (4.6 Kcal/g)
<b>Nutrient Information</b>	<b>% Kcal from</b>	<b>% Kcal from</b>	<b>% Kcal from</b>
Protein	22.5	18.0	18.0
Carbohydrate	65.4	42.0	42.0
Fat	12.1	40.0	40.0
<b>Formula</b>	<b>Representative Ingredients</b>	<b>g/kg</b>	<b>g/kg</b>
Casein	Soybean meal	200	200
DL-Methionine	Lysine	3	3
Corn starch	Ground corn	111	109
Sucrose	Wheat flour	370	370
Cellulose	Wheat middlings	50	50
Corn oil	Fish meal	30	30
Lard		170	170
Cholesterol	Soybean oil	10	10
Mineral mixture	Mineral mixture, Calcium carbonate, Calcium bicarbonate	42	42
Vitamin mixture	Vitamin mixture	12	12
Choline bitartrate	Choline chloride	2	2
tert-Butylhydroquinone	/	0.04	0.04

Eugenol

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**Table S2.** Primer sequences used for RT-qPCR.

Type	Gene Description	Sequences (5'→3')
Mouse	Muscle atrophy F-box ( <i>MAFbx</i> )	F: GTCCAGAGAGTCGGCAAGTC R: GTCGGTGATCGTGAGACCTT
	Muscle RING finger 1 ( <i>MuRF1</i> )	F: ACATCTACTGTCTCACGTGT R: TGTCCTTGGAAGATGCTTTG
	Peroxisome proliferator-activated receptor gamma coactivator 1-alpha ( <i>PGC-1α1</i> )	F: TAAATCTGCGGGATGATGGA R: GTTTCGTTTCGACCTGCGTAA
	Insulin-like growth factor 1 ( <i>IGF-1</i> )	F: TGCTGATTTTCCCATCGCT R: AGAGCCTGCGCAATGGAATA
	Myostatin	F: TCACGCTACCACGGAAACAA R: AGGAGTCTTGACGGGTCTGA
	Peroxisome proliferator-activated receptor gamma coactivator 1-alpha4 ( <i>PGC-1α4</i> )	F: TCACACCAAACCCACAGAAA R: CTGGAAGATATGGCACAT
	Flap structure-specific endonuclease 1 ( <i>Fen1</i> )	F: GGTGGAGGAGAGGTGACTAG R: GCACA ACTACTGGACTCAGC
	Heme oxygenase 1 ( <i>Hmox1</i> )	F: CCTCACAGATGGCGTCACTT R: TGGGGGCCAGTATTGCATTT
	Leptin ( <i>Lep</i> )	F: GCTACAGGCCTTTTGTGGC R: CCACAGAATGGGTGGGAGAC
	Nuclear factor (erythroid-derived 2)-like 2 ( <i>Nfe2l2</i> )	F: AGGACATGGAGCAAGTTTGG R: TTGCCCTAAGCTCATCTCGT
	V-rel reticuloendotheliosis viral oncogene homolog A ( <i>Rela</i> )	F: GAGCCATTGGAGTTCCAGTA R: TGGGGGAAA ACTCATCAAAG
	Transferrin receptor ( <i>Tfrc</i> )	F: GGAAGACTCTGCTTTGCAGCTAT R: GCCCAGGTAGCCACTCATGA
	Ubiquitin-like, containing PHD and RING finger domains, 1 ( <i>Uhrfl</i> )	F: CTTCTTCACTCCCCTCACCA R: TCCATGACACCCAGTCAGTG
	Glyceraldehyde-3-phosphate dehydrogenase ( <i>GAPDH</i> )	F: GTGATGGCATGGACTGTGGT R: GGAGCCAAAAGGGTCATCAT

**Table S3.** Global network parameters.

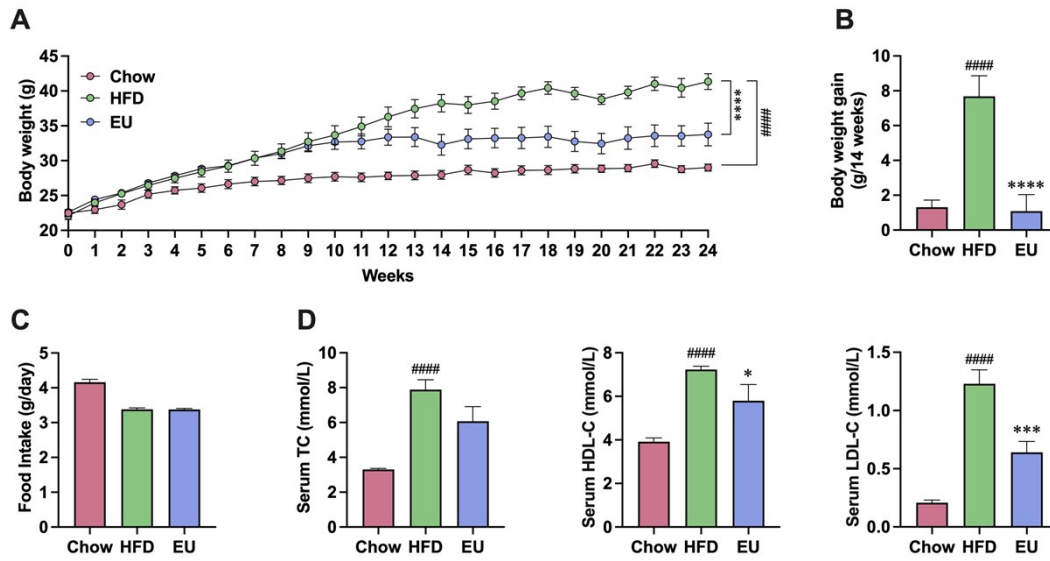
Parameters	Chow	HFD	EU
node number	88	80	79
edge number	237	195	225
clustering coefficient	0.475	0.513	0.476
characteristic path length	3.419	4.395	3.518
average degree	5.944	5.067	6.235
graph density	0.084	0.086	0.093

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**Table S4.** Multi-omics network parameters

Node1 Name	Node2 Name	Coefficient
7-demethylsuberosin	Rela	-0.53619
Pg 32:0	g__Muribaculum	-0.66667
Guanine	g__Muribaculum	-0.67026
His-Lys	g__Muribaculum	-0.66667
AICAR	g__Muribaculum	-0.62366
DI-2-aminocaprylic acid	g__Muribaculum	0.84588
Betonicine	g__Muribaculum	0.80287
Hmox1	g__Faecalibaculum	0.57357
Tfrc	g__Faecalibaculum	-0.7248

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13 **Figure S1.** Supplementation of EU attenuates obesity in HFD-fed mice. (A) Body  
 14 weight change. (B) Body weight gain during 14-week EU supplementation. (C) Daily  
 15 food intake during 14-week EU supplementation. (D) Serum TC, HDL-C, and LDL-C  
 16 levels. Data were represented as the mean  $\pm$  SEM and were analyzed using one-way  
 17 ANOVA with Dunnett's multiple-comparisons test.  $n = 8-10$ . ##### $p < 0.0001$   
 18 compared with Chow group. \* $p < 0.05$ , \*\*\* $p < 0.001$ , \*\*\*\* $p < 0.0001$  compared with  
 19 HFD group.