

1 **Supplemental Tables**

2 **Supplemental Table 1 . Fatty acid composition of the employed PCs and fish oil**

Fatty acid (%)	EPA/DHA- PC	Soy-PC	Egg-PC	EPA/DHA- TG
C14:0	0.99	0.43	0.23	5.86
C16:0	23.48	14.9	28.15	19.56
C16:1 n-9	2.36	1.02	2.59	3.27
C18:0	11.15	3.09	21.57	6.45
C18:1n-9	9.08	9.96	27.17	12.12
C18:2n-6	0.39	59.13	11.32	4.10
C18:3n-6	--	0.19	0.39	4.23
C18:3n-3	--	6.75	1.57	--
C20:1n-9	12.48	1.37	1.49	1.52
C20:4n-6	1.82	1.21	3.71	1.25
C20:5(EPA)	9.72	--	--	10.04
C22:6(DHA)	27.11	--	--	30.32

3 *Note: "--", none detected;*

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**Supplemental Table 2.** Composition of experimental diets

Ingredients (g/kg)	Con	HF	EPA/DHA- PC	Soy-PC	Egg-PC	EPA/DHA- TG
Casein	200	200	200	200	200	200
Cornstarch	450	250	250	250	250	250
Sucrose	200	200	200	200	200	200
Corn oil	50	50	50	50	50	50
Lard	0	200	180	180	180	180
Mineral mix	35	35	35	35	35	35
Vitamin mix	10	10	10	10	10	10
Cellulose	50	50	50	50	50	50
Choline bitartrate	2	2	2	2	2	2
DL-methionine	3	3	3	3	3	3
EPA/DHA-PC	--	--	20	--	--	--
Soy-PC	--	--	--	20	--	--
Egg-PC	--	--	--	--	20	--
Fish oil	--	--	--	--	--	20

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**Supplemental Table 3.** Effect of different PCs treatment on fatty acid composition in serum of the Mice

Fatty acid (%)	Con	HF	EPA/DHA-PC	Soy-PC	Egg-PC	EPA/DHA-TG
C14:0	0.47±0.13	0.25±0.12	0.16±0.17	0.19±0.11	0.19±0.30	0.25
C15:0	0.32±0.13	0.17±0.09	0.11±0.09	0.13±0.16	0.14±0.13	0.12±0.12
C16:0	20.21±4.45	19.37±1.96	18.91±1.77	16.47±1.84	19.19±2.80	18.71±1.44
C16:1n-9	1.88±0.44	1.22±0.31*	1.51±0.62	1.31±0.54	1.26±0.43	1.32±0.71
C17:0	1.35±0.56	1.42±0.33	1.23±0.21	1.34±0.16	1.19±0.32	1.14±0.44
C17:1n-7	0.23±0.09	0.17±0.05	0.17±0.07	0.14±0.09	0.16±0.07	0.14±0.08
C18:0	10.19±0.97	18.23±2.13**	15.34±2.09	17.20±1.78	16.76±2.36	16.42 ±1.99
C18:1n-9	22.44±4.35	26.05±2.03	21.88±3.09	22.91±2.10	25.37±2.89	23.42±3.01
C18:2n-6	24.68±4.90 <sup>a</sup>	10.28±1.43**	11.58±2.33	18.68±3.18##	11.59±2.10	11.15±2.77
C18:3n-6	0.25±0.41	0.16±0.11	0.13±0.14	0.10±0.19	0.12±0.11	0.18±0.14
C18:3n-3	1.37±0.38 <sup>a</sup>	0.29±0.12**	0.23±0.11	0.38±0.13#	0.42±0.29	0.22±0.22
C20:0	0.90±1.03	0.47±0.17	0.33±0.21	0.27±0.22	0.22±0.19	0.31±0.27
C20:1n-9	1.20±0.35	0.93±0.41	1.20±0.44	0.99±0.31	1.13±0.56	1.18±0.47
C20:2n-6	0.72±0.44	0.51±0.22	0.51±0.32	0.43±0.36	0.64±0.38	0.66±0.23
C20:3n-6	1.05±0.41	2.35±1.02	1.85±0.64	1.93±0.42	2.46±1.33	1.71±0.77
C20:4n-6	7.19±1.54	11.25±2.39*	8.49±1.45#	10.74±1.34	13.14±1.19	7.86±2.16#
C22:0	0.99±0.46	0.82±0.38	0.66±0.52	0.68±0.25	0.49±0.22	0.52±0.24
C20:5n-3	0.12±0.11	0.15± 0.10	4.97±0.41##	0.18±0.12	0.52±0.40	4.12±0.22##
C22:1n-9	0.47±0.21	0.73±0.43	0.72±0.44	0.65±0.31	0.61±0.60	0.74±0.47
C22:6n-3	3.97±0.40	5.18±0.70*	10.02±1.27##	5.28±0.89	4.40±1.07	9.83±0.97##
Total SFA	34.43±1.39	40.73±1.71*	36.74±1.93#	36.28±1.22#	38.18±2.19	37.47±1.33
Total MUFA	26.22±1.96	29.10±1.52	25.48±1.84	26.00±1.60	28.53±1.72	26.80±1.96
Total PUFA	39.35±1.67	30.17±1.66**	37.78±1.21##	37.72±2.06##	33.29±1.53	35.73±1.82
Total n-6	33.89±1.45	24.55±1.77**	22.56±1.82	31.88±1.69##	27.95±1.73	21.56±1.58
PUFA						
Total n-3	5.46±1.40	5.62±1.04	15.22±1.28##	5.84±1.07	5.34±1.03	14.17±1.31##
PUFA						

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41 Results are presented as means ± SD

42 \**p* < 0.05, \*\**p* < 0.01 compared to Con group. #*p* < 0.05, ##*p* < 0.01 compared to HF group.

43 SFA, saturated fatty acids; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; ND, not detected.

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**Supplemental Table 4.** Effect of different PCs treatment on Fatty acid composition in liver of HFD Fed Mice

Fatty acid (%)	Con	HF	EPA/DHA-PC	Soy-PC	Egg-PC	EPA/DHA-TG
C14:0	0.29±0.06	0.21±0.05	0.16±0.10	0.16±0.07	0.16±0.11	0.16±0.06
C15:0	0.12±0.05	0.11±0.03	0.08±0.03	0.09±0.08	0.24±0.16	0.04±0.02
C16:0	17.21±1.88	15.25±1.56	16.05±1.49	14.10±1.66	12.96±2.35	14.06±1.98
C16:1n-9	3.11±0.63	2.51±0.58	1.84±1.03	1.07±1.12	1.27±0.84	1.28±0.77
C17:0	0.81±0.12	1.05±0.13	1.25±0.13	0.94±0.08	1.02±0.13	1.89±0.10
C17:1	0.19±0.04	0.18±0.03	0.12±0.03	0.13±0.04	0.16±0.05	0.24±0.03
C18:0	10.19±1.11	16.90±1.82**	16.62±1.54	17.11±1.66	19.48±2.01	18.41±1.74
C18:1n-9	31.07±2.32	27.26±2.99	26.61±3.13	26.79±2.09	28.11±2.73	26.24±2.86
C18:2n-6	18.26±1.27	16.26±1.56	14.81±2.01	19.48±1.31##	15.21±1.42	15.13±1.37
C18:3n-6	0.87±0.10	0.24±0.07**	0.12±0.10	0.25±0.06	0.27±0.05	0.24±0.04
C18:3n-3	1.26±0.33	0.33±0.15**	0.13±0.11	0.63±0.22##	0.55±0.27	0.25±0.13
C20:1n-9	1.89±0.45	2.2±0.48	1.25±0.36	1.81±0.31	2.29±0.42	1.42±0.29
C20:2n-6	0.92±0.11	1.2±0.20	0.69±0.17	0.9±0.21	1.15±0.32	0.82±0.18
C20:3n-6	1.49±0.23	2.04±0.39	1.5±0.42	1.42±0.37	1.61±0.36	1.64±0.48
C20:4n-6	7.87±1.52	8.81±1.77	5.23±1.34##	9.12±1.86	10.43±2.01	6.16±1.22##
C22:0	0.13±0.10	0.32±0.11	0.21±0.13	0.12±0.12	0.27±0.13	0.39±0.14
C20:5n-3	0.09±0.02	0.11±0.02	2.59±0.45##	0.13±0.02	0.13±0.02	2.25±0.22##
C22:1n-9	0.46±0.04	0.52±0.05	0.46±0.04	0.58±0.06	0.55±0.05	0.59±0.04
C22:6n-3	3.77±0.44	4.50±0.38	10.28±1.02##	5.17±0.53	4.14±0.62	8.79±0.94##
Total SFA	28.72±1.82	33.84±2.33**	34.37±2.02	32.52±2.42	34.13±2.15	34.95±2.21
Total MUFA	36.72±1.77	32.67±1.87**	30.28±1.92	30.38±1.73	32.38±1.85	29.77±1.76
Total PUFA	34.56±2.01	33.49±2.33	35.35±1.35#	37.1±2.22#	33.49±2.62	35.28±2.51#
Total n-6 PUFA	29.44±1.79	28.55±1.89	22.35±1.62##	31.17±1.89#	28.67±1.77	23.99±1.82##
Total n-3 PUFA	5.12±0.92	4.94±0.66	13.00±1.32##	5.93±0.62	4.82±0.66	11.29±1.13##

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Results are presented as means ± SD

\**p* < 0.05, \*\**p* < 0.01 compared to Con group. #*p* < 0.05, ##*p* < 0.01 compared to HF group.

SFA, saturated fatty acids; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; ND, not detected.

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80 **Supplemental Table 5.** Effect of different PCs treatment on Fatty acid composition in epididymis fat of the Mice

Fatty acid (%)	Con	HF	EPA/DHA-PC	Soy-PC	Egg-PC	EPA/DHA-TG
C14:0	0.83±0.05	1.49±0.10	1.22±0.15	1.57±0.13	1.59±0.12	1.54±0.09
C15:0	0.31±0.03	0.25±0.02	0.15±0.02	0.14±0.01	0.14±0.01	0.18±0.02
C16:0	17.72±1.65	21.46±1.73**	18.41±1.74	13.16±1.46##	19.92±1.81	19.14±1.83
C16:1n-9	4.57±0.43	4.90±.51	4.75±0.52	3.72±0.39	4.99±0.42	4.84±0.44
C17:0	1.79±1.03	2.05±1.32	2.51±1.29	4.52±1.53	2.18±1.88	2.29±1.46
C17:1	0.83±0.11	0.62±0.13	0.65±0.21	0.67±0.27	0.69±0.19	0.70±0.16
C18:0	7.68±1.10	11.94±1.33**	13.29±1.37	12.15±1.25	13.93±1.31	12.94±1.26
C18:1n-9	31.97±2.17	33.35±2.28	31.58±2.06	32.20±1.98	33.54±2.31	32.62±1.95
C18:2n-6	19.23±1.41	11.89±1.80**	12.17±1.28	18.37±1.66##	11.81±1.32	12.87±1.33
C18:3n-6	0.59±0.06	0.37±0.04	0.23±0.03	0.37±0.04	0.34±0.04	0.27±0.03
C18:3n-3	2.27±0.29	0.88±0.11**	0.77±0.31	1.09±0.39	0.89±0.20	0.82±0.19
C20:1n-9	4.43±0.37	4.58±0.42	6.61±0.53	5.55±0.56	4.31±0.47	4.27±0.44
C20:2n-6	2.68±0.38	2.62±0.32	2.17±0.28	2.51±0.26	2.45±0.39	2.74±0.58
C20:3n-6	1.73±0.20	1.07±0.16	1.68±0.17	1.41±0.15	0.86±0.13	1.48±0.21
C20:4n-6	1.02±0.13	1.05±0.13	0.77±0.12#	0.89±0.11	1.13±0.15	0.82±0.11#
C22:0	0.47±0.03	0.24±0.02	0.32±0.04	0.48±0.03	0.24±0.03	0.25±0.02
C20:5n-3	0.23±0.03	0.13±0.02	0.54±0.03##	0.23±0.03	0.16±0.02	0.51±0.05##
C22:1n-9	0.90±0.10	0.65±0.11	0.77±0.10	0.7±0.09	0.47±0.08	0.66±0.17
C22:6n-3	0.75±0.11	0.46±0.09	1.41±0.12##	0.27±0.14	0.36±0.15	1.06±0.14##
Total SFA	28.80±1.79	37.43±2.33	35.9±2.42	32.02±2.19	38.00±2.79	36.34±2.63
Total MUFA	42.70±2.86	44.10±3.01	44.36±2.77	42.84±2.79	44.00±3.41	43.09±2.84
Total PUFA	28.50±1.65	18.47±1.57	19.74±1.82	25.14±1.89	18.00±1.64	20.57±1.89
Total n-6 PUFA	25.25±1.73	17.00±1.62	17.02±1.59	23.55±2.06	16.59±1.84	18.18±1.99
Total n-3 PUFA	3.25±0.33	1.47±0.29**	2.72±0.24##	1.59±0.36	1.41±0.31	2.39±0.39##

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Results are presented as means ± SD

\**p* < 0.05, \*\**p* < 0.01 compared to Con group. #*p* < 0.05, ##*p* < 0.01 compared to HF group.

SFA, saturated fatty acids; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; ND, not detected.

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**Supplemental Table 6.** Primers used during the real-time PCR assay

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Gene	Forward/reverse primer
IRS1	5'-ATGTCGCCAGTGGGAGATT-3'
	5'-CTTCGGCAGTTGCGGTATA-3'
IRS2	5'-GACGGCTGTTTCGCAATT-3'
	5'-GGACGCCAAGCACAAGTA-3'
PI3K	5'-CCTCTCCTTATAAAGCTCCTGGAA-3'
	5'-GATCACAATCAAGAAGCTGTCGTAA-3'
AKT2	5'-TTCTACAACCAGGACCACGAGC-3'
	5'-TGATGCTGAGGAAGAACCGATG-3'
GYS2	5'-CCAGCTTGATAAGTTCAACA-3'
	5'-ATCAGGCTTCCTCTTCAGCA-3'
G6pase	5'-GAAGGCCAAGAGATGGTGTGA-3'
	5'-TGCAGCTCTTGCGGTACATG-3'
PEPCK	5'-CCCAGGAAGTGAGGAAGTTTGT-3'
	5'-GGAGCCGTCGCAGATGTG-3'
GLUT2	5'-CTGTCTGTGTCCAGCTTTGCA-3'
	5'-CAAGCCACCCACCAAAGAAC-3'
GLUT4	5'-ACTAAGAGCACCGAGACCAA-3'
	5'-CTGCCC GAAAGAGTCTAAAG-3'
TLR4	5'-CCGCTCTGGCATCATCTTCATTGT-3'
	5'-CCATTCCAGGTAGGTGTTT-3'
GRP120	5'-GCATAGGAGAAATCTCATGG-3'
	5'-GAGTTGGCAAACGTGAAGGC-3'
JNK	5'-TGACGCCTTATGTGGTGA-3'
	5'-TGATGTATGGGTGCTGGAGA-3'
NF-kB	5'-GTTGGGTCTGGGGATACTGA-3'
	5'-AACCGTGGGGCATT TTTGT-3'
IL-6	5'-AGCCAGAGTCCTTCAGAGAGAT-3'
	5'-GCACTAGGTTTGCCGAGTAGA T-3'
IL-1 $\beta$	5'-CTCCATGAGCTTTGTACAAGG-3'

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	5'-TGCTGATGTACCAGTTGGGG-3'
TNF- $\alpha$	5'-CACCACGCTCTTCTGT-3'
	5'-CTTTGAGATCCATCG-3
IL-10	5'-GGCGCTGTCATCGATT-3'
	5'-AGCTCTGTCTAGGTCC-3'

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106 **Supplemental Table 7.** Correlation analysis between the IR related parameters with the relative abundance of gut

107 microbiota at genus level

	HOMA-IR		Serum insulin		Fasting glucose	
	r	p	r	p	r	p
Ileibacterium	0.517	0.020	0.380	0.098	0.675	0.001
norank_f__Muribaculaceae	0.075	0.754	0.021	0.929	0.121	0.611
Akkermansia	-0.671	0.001	-0.522	0.018	-0.766	0.000
Lactobacillus	-0.672	0.001	-0.549	0.012	-0.757	0.000
Dubosiella	0.483	0.031	0.671	0.001	0.240	0.307
Bifidobacterium	0.353	0.127	0.326	0.161	0.431	0.058
Coriobacteriaceae_UCG-002	-0.457	0.043	-0.301	0.198	-0.560	0.010
Clostridium_sensu_stricto_1	-0.766	0.000	-0.778	0.000	-0.714	0.000
Bacteroides	-0.441	0.052	-0.426	0.061	-0.430	0.058

108 Pearson correlation test was performed by SPSS 19.0 software; r, correlation coefficient; Statistical significance was set to

109  $p < 0.05$ 

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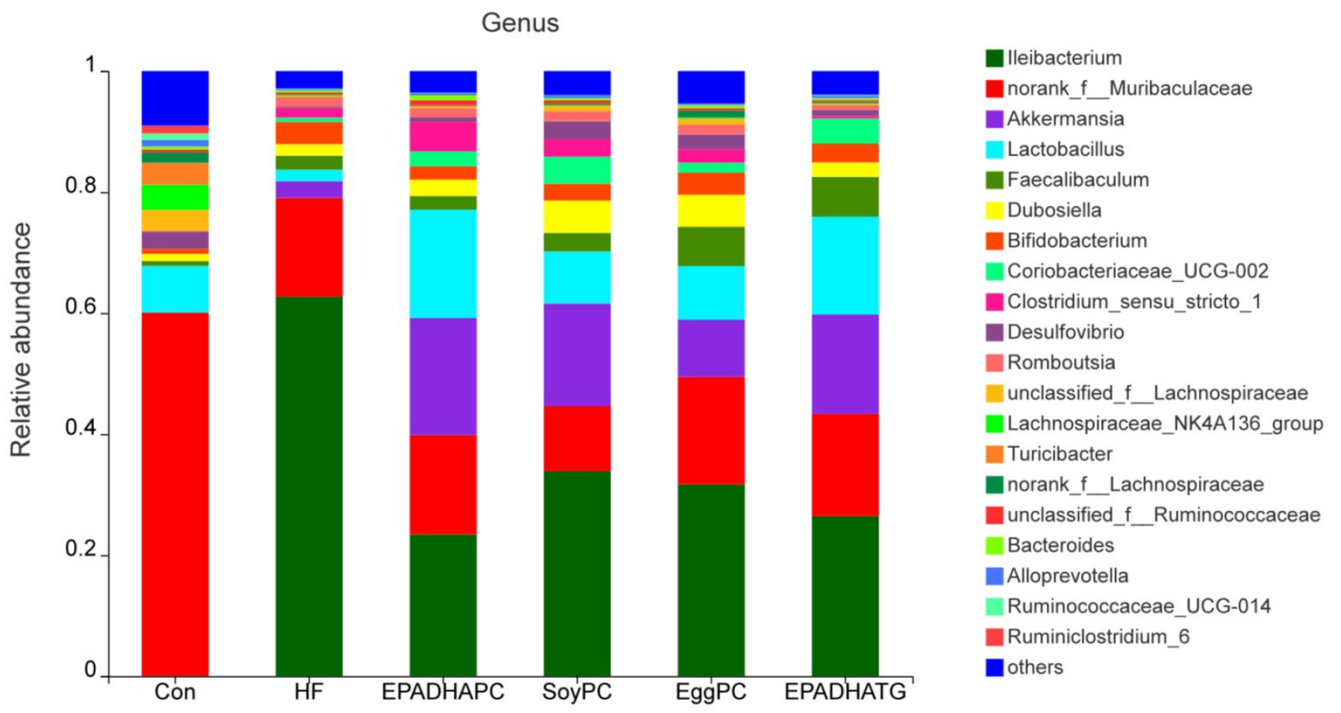
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142 **Supplemental Figure 1 .** Effects of PCs on microbial distributions of different groups at the genus level.



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