

Supplementary Table1. The Formula of 60% HFD

Ingredient	gm	kcal
Casein, 80 Mesh	200	800
L-Cystine	3	12
Maltodextrin 10	125	500
Sucrose	68.8	275.2
Cellulose, BW200	50	0
Soybean Oil	25	225
Lard	245	2205
Mineral Mix, S10026	10	0
DiCalcium Phosphate	13	0
Calcium Carbonate	5.5	0
Potassium Citrate, 1 H ₂ O	16.5	0
Vitamin Mix, V10001	10	40
Choline Bitartrate	2	0
FD&C Blue Dye #1	0.05	0
Total	773.85	4057

Supplementary Table.2 Diversity and richness of cecal microbiota in control mice, HFD-fed, and fuc-Pg -treated mice

Groups	Reads	OTUs	Q30	Chao1	Shannon indices	Simpson indices
Control	52879±7451	1085±81*	92.88±0.05	1348±80*	7.65±0.21*	0.978±0.009
HFD	43506±9954	682±72 [#]	92.57±0.11	857±94 [#]	5.93±0.41 [#]	0.938±0.012
fuc-Pg	35941±4864	672±103 [#]	92.70±0.14	858±130 [#]	6.25±0.43 [#]	0.95±0.018

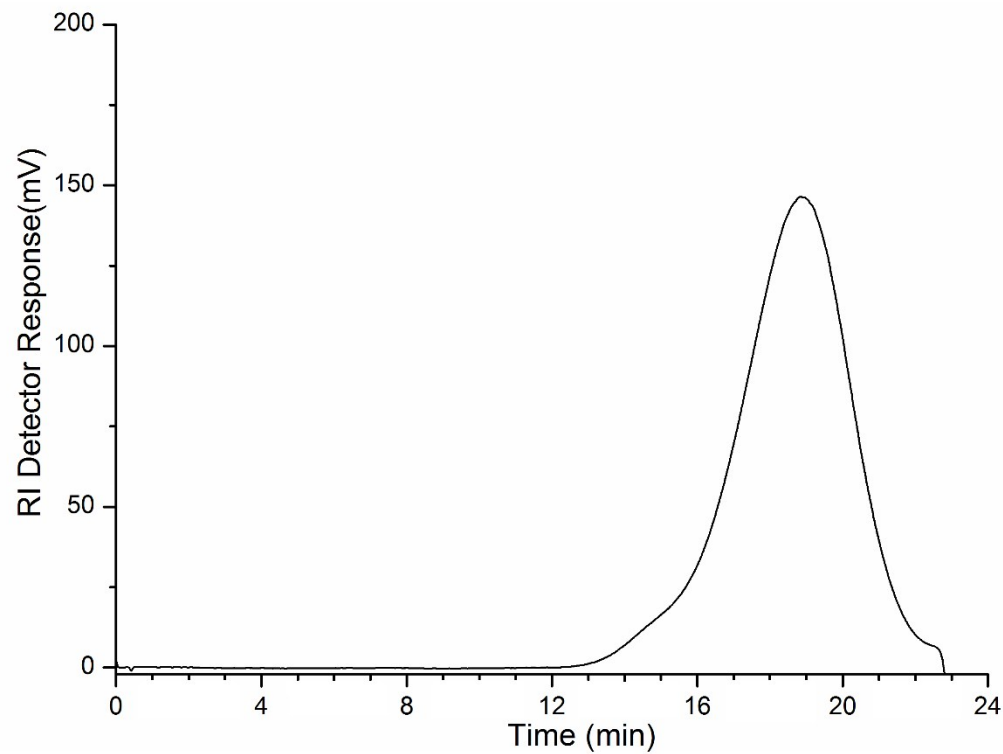
*P < 0.05: compared with HFD group. [#] P < 0.05: compared to normal control group. Data are presented as mean ± SD, n = 5. The control group was supplied with common commercial chow and all the other groups were supplied with HFD.

Supplementary Table.3 Diversity and richness of colonic microbiota in control mice, HFD-fed, and fuc-Pg -treated mice

Groups	Reads	OTUs	Q30	Chao1	Shannon indices	Simpson indices
Control	35602±6652	907±175*	92.55±0.22	1109±195*	7.4±0.39*	0.98±0.006
HFD	43383±4168	765±40 [#]	92.13±0.46	975±77 [#]	6.34±0.39 [#]	0.95±0.015
fuc-Pg	34446±7942	554±89 [#]	91.72±0.37	717±117 [#]	6.28±0.72 [#]	0.96±0.034

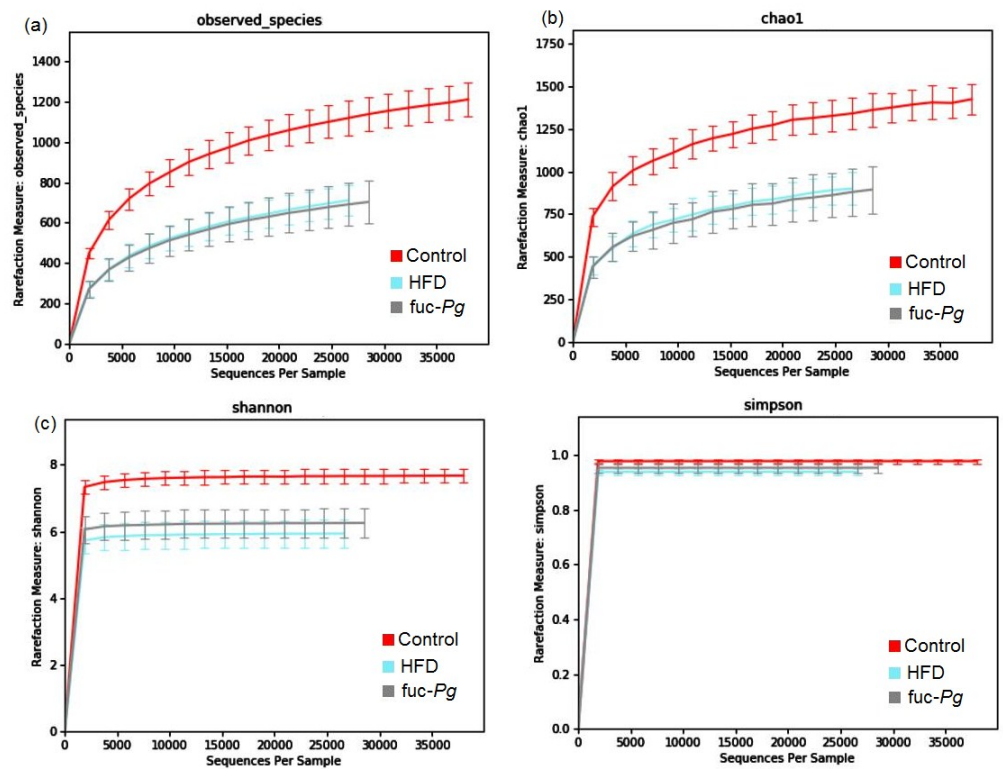
*P < 0.05: compared with HFD group. [#] P < 0.05: compared to normal control group. Data are presented as mean ± SD, n = 5. The control group was supplied with common commercial chow and all the other groups were supplied with HFD.

Supplementary Fig.1

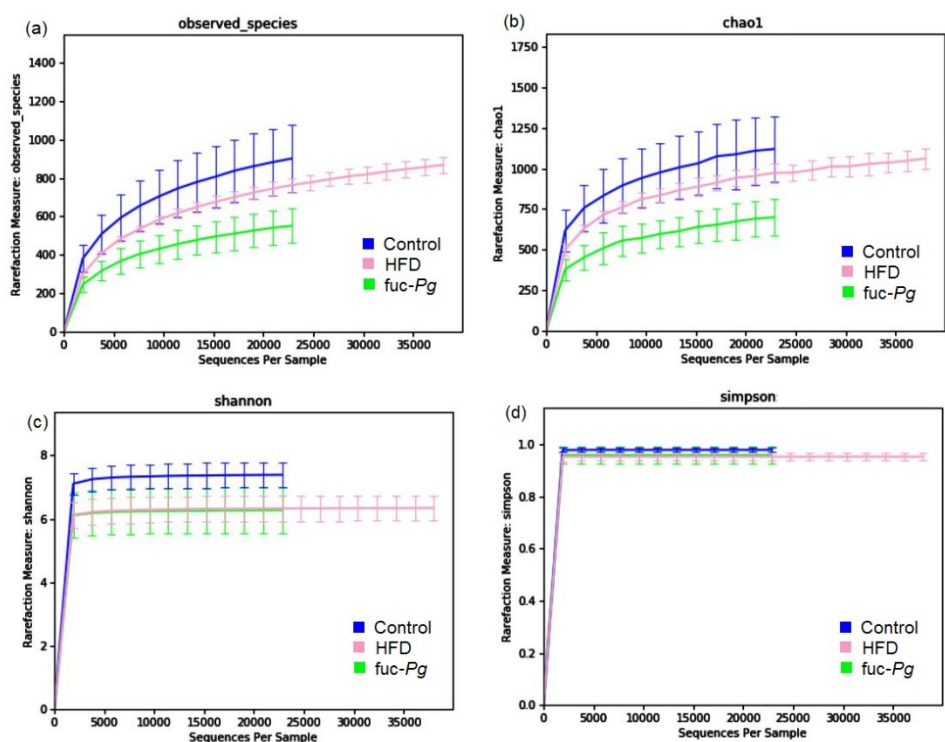


Supplementary Fig 1. HPSEC profile of purified fuc-*Pg*.

Supplementary Fig.2a

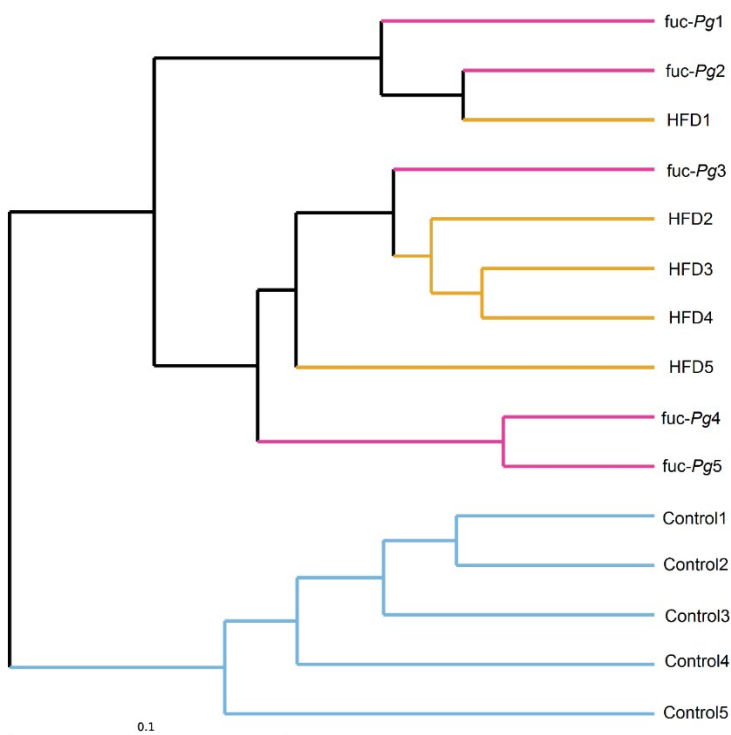


Supplementary Fig.2b

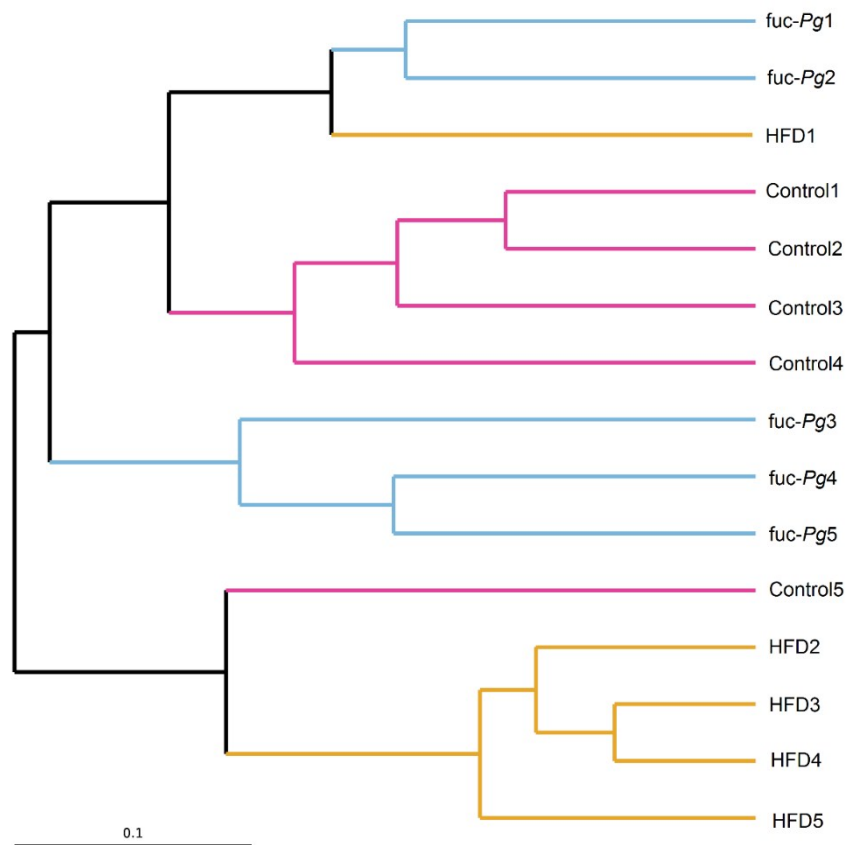


Supplementary Figure.2a Rarefaction curves of observed species, chao1, Shannon indices and Simpson indices in the cecal microbiota. **Supplementary Figure.2b** Rarefaction curves of observed species, chao1, Shannon indices and Simpson indices in the colonic microbiota.

Supplementary Fig.3a

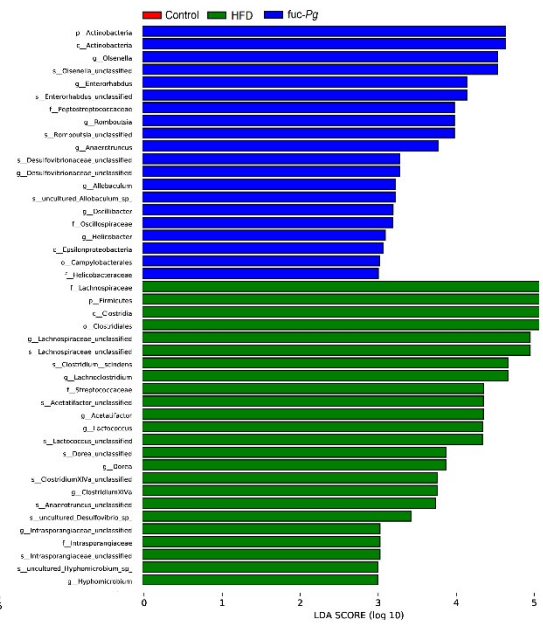
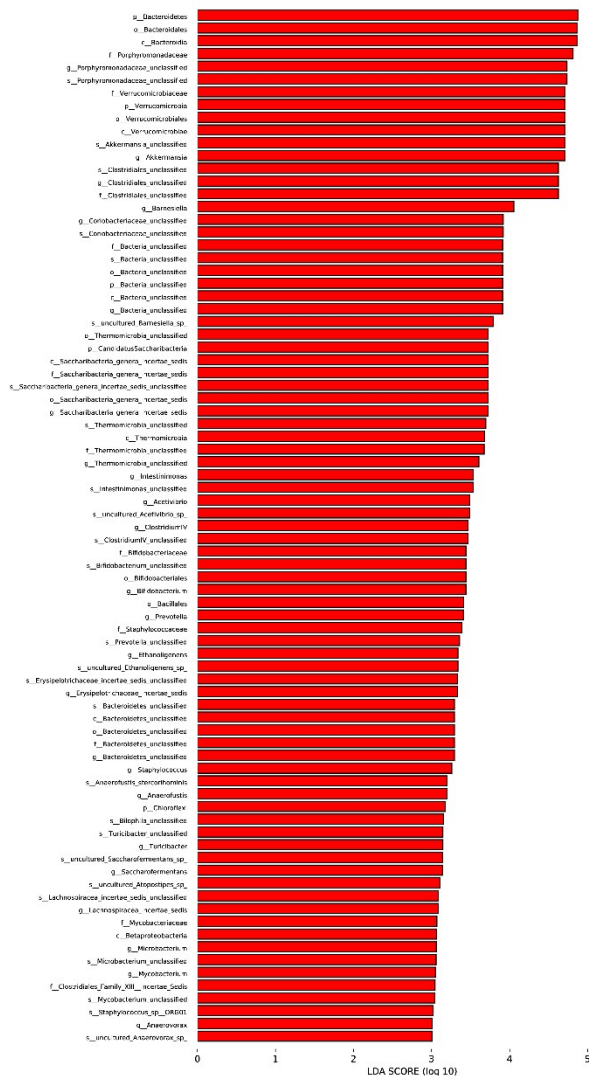


Supplementary Fig.3c

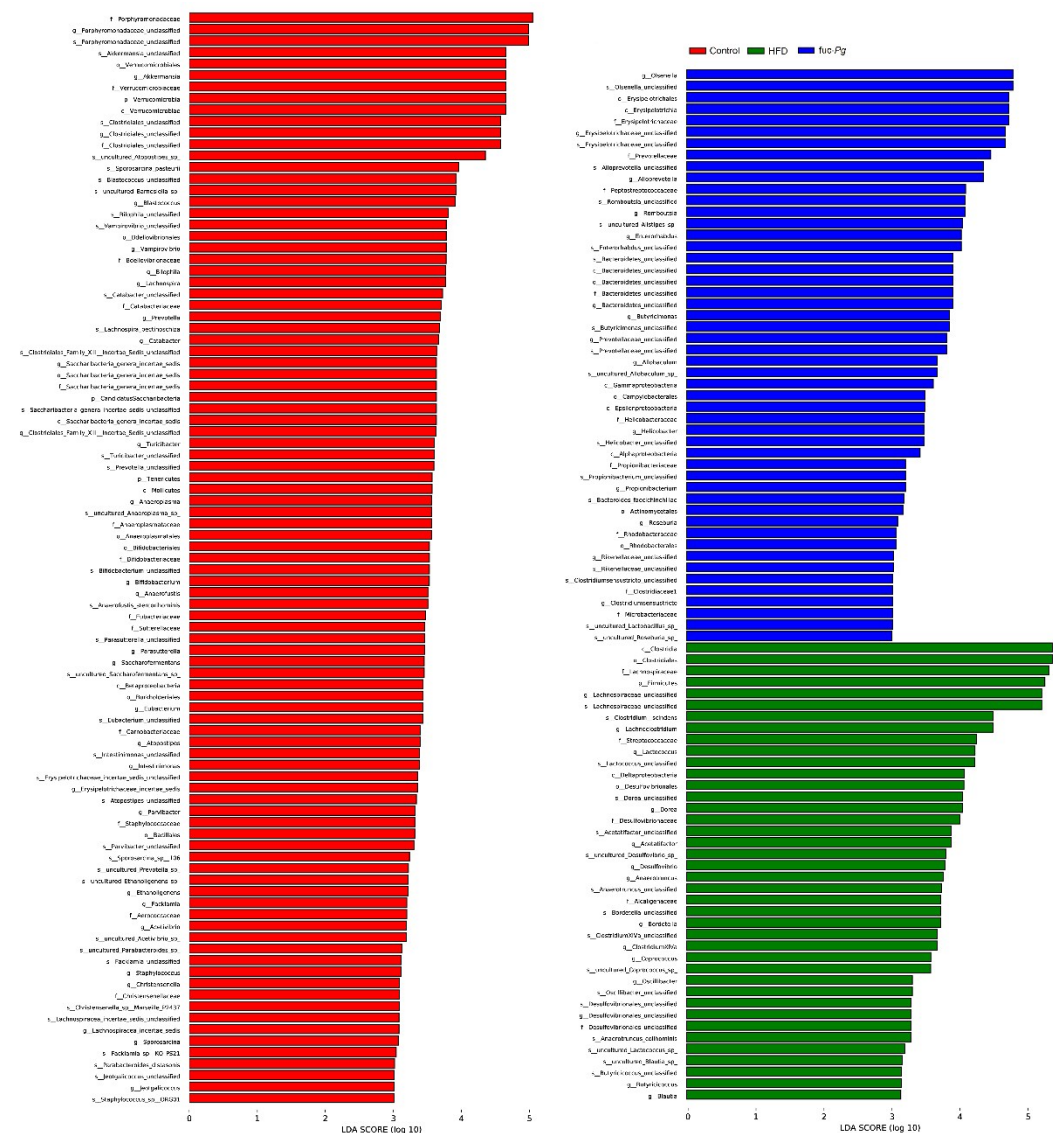


Supplementary Figure.3 Unweighted Pair Group Method with Arithmetic Mean (UPGMA) cluster of cecal microbiota **(a)** and colonic microbiota **(b)** among the Control, HFD, and fuc-*Pg* groups.

Supplementary Fig.4a



Supplementary Fig.4b



Supplementary Fig.4 LefSe comparison of gut microbiota. LDA score of cecal microbiota between the control, HFD and fuc-Pg group (a); LDA score of colonic microbiota between the control, HFD and fuc-Pg group (b). Only taxa meeting an LDA score threshold > 3 are listed.