

Supplemental Material

Supplemental Table S1. Primer sequences used for Real-time PCR analysis, *A. muciniphila* quantification and 16S rRNA.

Gene	Forward Sequence (5'-3')	Reverse Sequence (5'-3')
Gapdh	TGGTGAAGCAGGCATCTGAG	TGCTGTTGAAGTCGCAGGAG
β-actin	GGAGAGAAGGGAACCAAAGG	AGGGAAGCCAGTCATAACCAG
ZO-1	ACCCGAAACTGATGCTGTGGATAG	AAATGGCCGGGCAGAACTTGTGTA
Occludin	GGAGGACTGGGTCAGGGAATA	CGTCGTCTAGTTCTGCCTGT
MUC2	GAAGCCAGATCCCGAAACCA	GAATCGGTAGACATCGCCGT
TLR2	ACCAAGATCCAGAAGAGCCA	CATCACCGGTCAGAAAACAA
TLR4	CACCAGGAAGCTTGAATCCCT	GGAATGTCATCAGGGACTTTGC
TLR5	GCAGGATCATGGCATGTCAAC	ATCTGGGTGAGGTTACAGCCT
MYD88	CCGCCTATCGCTGTTCTTGA	GCCAGGCATCCAACAAACTG
NF-κB	CTGGGCACCAGTTCGATGG	TGACAGCATAAGGCACACACT

Quantification.	Forward Sequence (5'-3')	Reverse Sequence (5'-3')
<i>Akkermansia muciniphila</i>	CAGCACGTGAAGGTGGGGAC	CCTTGCGGTTGGCTTCAGAT

Lung 16S rRNA primer	Forward Sequence (5'-3')	Reverse Sequence (5'-3')
Amplification primer	AGAGTTTGATCCTGGCTCAG	GNTACCTTGTTACGACTT
16S rRNA V3V4	CCTAYGGGRBGCASCAG	GGACTACNNGGGTATCTAAT

Feces 16S rRNA primer	Forward Sequence (5'-3')	Reverse Sequence (5'-3')
16S rRNA V3V4	TACGGRAGCAGAG	AAGGTATCTAATCCT

Supplemental Table S2. List of antibodies and ELISA kit we used

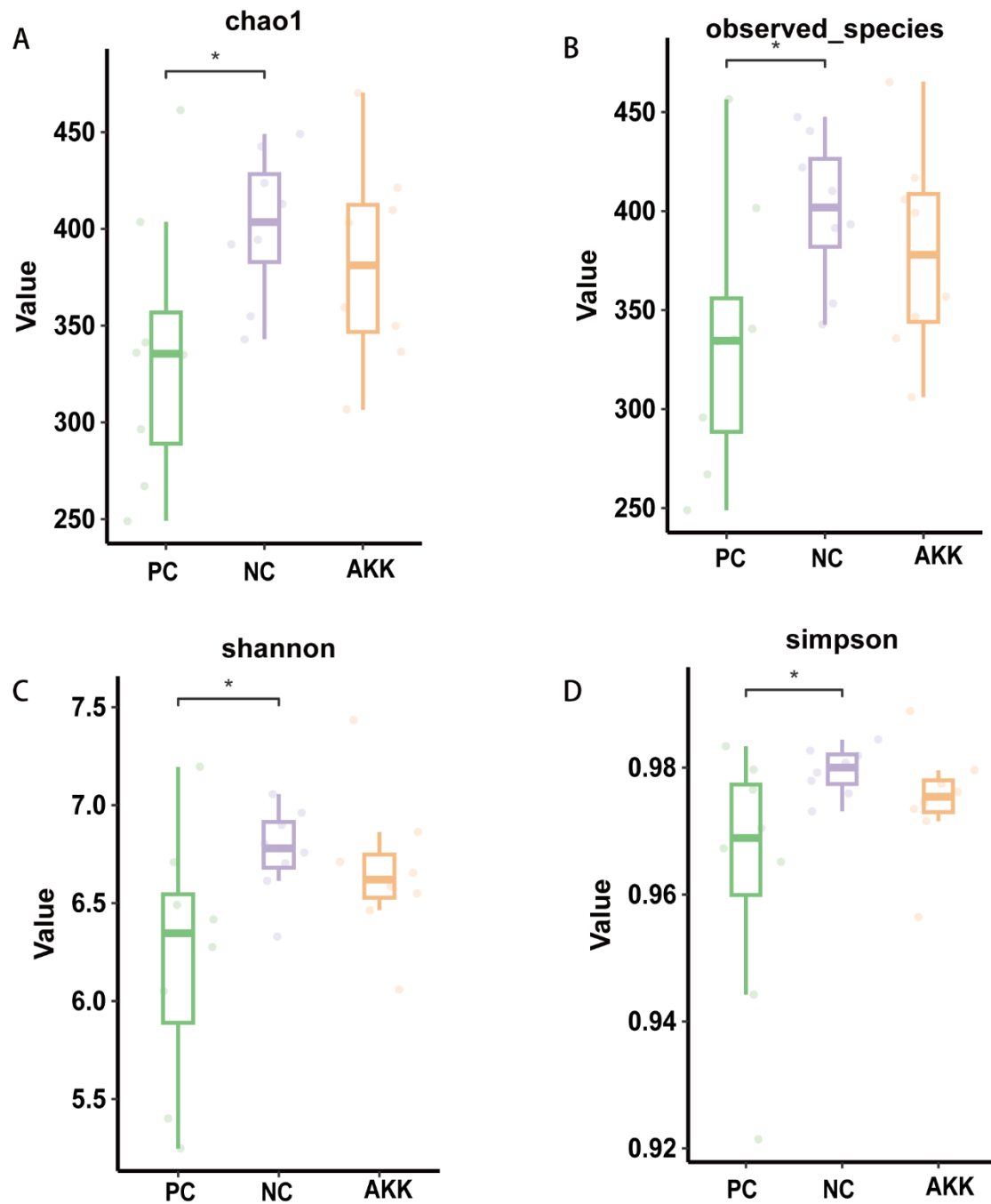
Antibody name	Catalog number	Manufacturer
Anti-Myeloperoxidase antibody	ab208670	Abcam, Cambridge, UK
Anti-Ly6g antibody	ab238132	Abcam
F4/80 Rabbit mAb	70076S	Cell Signaling Technology, MA, USA
Anti-ZO1 tight junction protein antibody	ab221547	Abcam
Anti-Occludin antibody	ab216327	Abcam

ELISA kit name	Catalog number	Manufacturer
Mouse LBP ELISA Assay kit	ab269542	Abcam, Cambridge, UK
SOD Determination Kit	19160	Sigma-Aldrich, PA, USA
Lipid Peroxidation (MDA) Assay kit	ab118970	Abcam
Mouse IL-1 beta ELISA kit	ab197742	Abcam
Mouse IL-6 ELISA kit	ab222503	Abcam
Enhanced BCA Protein Assay Kit	P0010	Beyotime, Nanjing, China
Lactate Dehydrogenase Activity Assay Kit	MAK066	Sigma-Aldrich

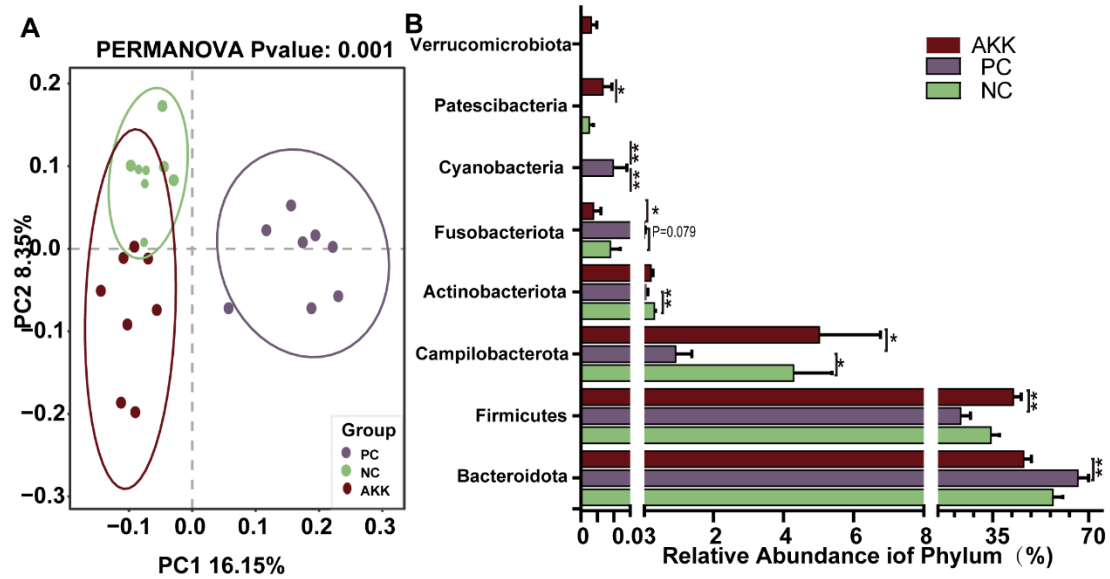
Supplementary Table S3. List of hub genes in PPI network of AKK vs PC.

Hub gene in cluster 1	Log2(fold change) in transcriptome (AKK vs PC)	P-value	Regulation
Tnf	-3.204178297	0.000437	downregulated
Lilr4b	-1.56858339	0.000758	downregulated
Bcl2a1b	-1.182020434	0.033646	downregulated
Bdkrb1	-1.368309161	0.005198	downregulated
C5ar1	-1.132436864	0.011974	downregulated
Casp1	-0.796837191	0.024685	downregulated
Ccl2	-2.755376319	0.00055	downregulated
Ccl20	-2.077085304	0.008089	downregulated
Ccl4	-2.9897643	0.000583	downregulated
Ccl9	-1.103842508	0.004593	downregulated
Ccr1	-1.605465072	0.001736	downregulated
Cd44	-0.489276361	0.042579	downregulated
Clec4n	-1.028954585	0.036211	downregulated
Csf1r	-0.889786024	0.033982	downregulated
Cxcl1	-3.446320805	9.54E-05	downregulated
Cxcl13	-2.072900146	0.012533	downregulated
Cxcl2	-4.762465368	1.63E-08	downregulated
Cxcl3	-3.287514873	0.012122	downregulated
Cxcl5	-3.166892054	0.019528	downregulated
Cxcl9	-3.062643588	0.035634	downregulated
Cxcr2	-1.218714173	5.04E-07	downregulated
Cyba	-0.934063339	0.022981	downregulated
Fcer1g	-1.22672505	0.002777	downregulated
Fcgr3	-1.513609542	0.020028	downregulated
Fcgr4	-1.526164474	0.000245	downregulated
Fpr1	-1.587359181	0.000137	downregulated
Fpr2	-2.431193418	8.19E-08	downregulated
Gbp2	-2.270570645	0.000259	downregulated
Gbp3	-1.653222049	0.00541	downregulated
Gbp7	-1.423049728	0.003462	downregulated
H2-T23	-0.948575564	0.001729	downregulated
Ifi204	-1.550758675	0.000341	downregulated
Ifi47	-1.574378091	0.006589	downregulated
Ifit1	-1.603991179	0.025082	downregulated
Igtp	-2.114969267	0.0013	downregulated
Il10	-2.242997239	0.0008	downregulated
Il10ra	-0.866464085	0.038821	downregulated
Il12b	-2.563852551	0.026182	downregulated
Il1b	-1.732200367	0.027157	downregulated
Irf7	-1.458434548	0.004253	downregulated

Irgm1	-1.725155188	0.000926	downreglated
Isg15	-1.771824711	0.00819	downreglated
Itgb2	-0.851837193	0.048566	downreglated
Jak2	-0.629473342	0.042668	downreglated
Ncf2	-1.028940823	7.23E-05	downreglated
Ncf4	-1.333298366	0.001234	downreglated
Nfkbia	-1.007011003	0.000208	downreglated
Oas1a	-1.060446107	0.042144	downreglated
Oas2	-1.253894038	0.008611	downreglated
Oas3	-1.678403454	0.001334	downreglated
Pilra	-0.915902476	0.023157	downreglated
Ptafr	-1.337969712	0.047313	downreglated
Samhd1	-0.963400283	0.000437	downreglated
Socs3	-1.311406039	0.000141	downreglated
Stat1	-1.167318807	0.040327	downreglated
Stat3	-0.441735523	0.003959	downreglated
Tap1	-1.357642406	0.001485	downreglated
Tlr2	-1.704103478	0.000516	downreglated
Tlr4	-0.456311223	0.02522	downreglated
Tyrobp	-0.877675879	0.033216	downreglated
Vav1	-1.062063524	0.029035	downreglated
Zbp1	-1.840291657	0.00375	downreglated

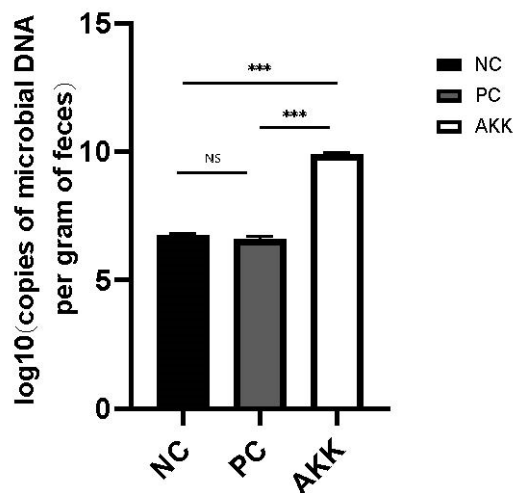


Supplementary Figure 1 The alpha-diversity indexes including Chao1 index(A), observed species index(B), Shannon index(C), and Simpson index) (D) of the gut microbiota among three groups were showed. Data are shown as the mean \pm SEM; Compared with the PC group, * $p < 0.05$. NC, PBS + saline group; PC, PBS+LPS group; AKK, *A. muciniphila* + LPS group. $n=8$ each group.

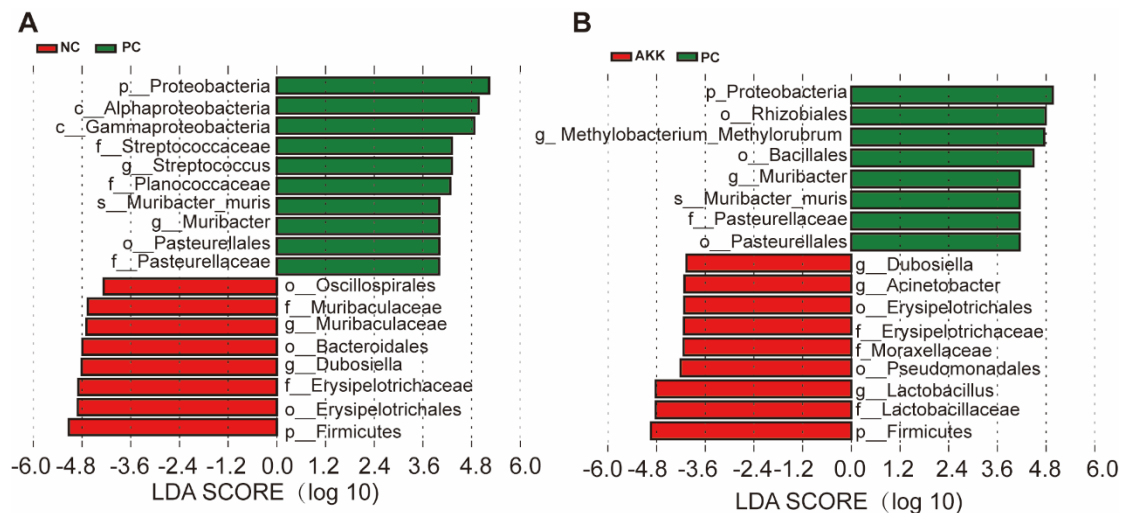


Supplementary Figure 2 *A. muciniphila* reshaped the gut microbiota of mice.

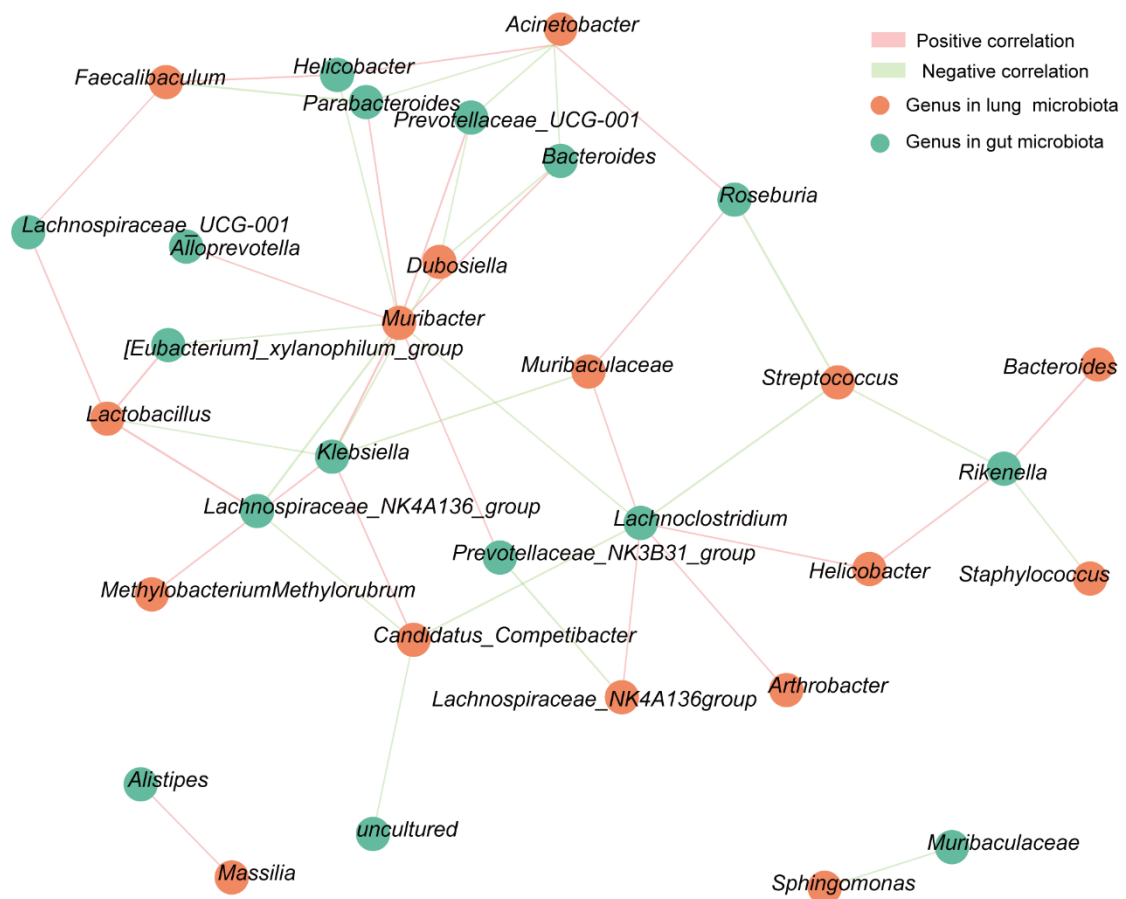
(A) A PCoA based on unweighted UniFrac distances showed that the microbial groups of AKK, NC, and LPS were significantly separated ($p < 0.01$). (B) Comparisons of the relative abundances of intestinal microbiota between the three groups were performed at the phylum levels. Data are shown as the mean \pm SEM; Compared with the PC group, * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$. NC, PBS + saline group; PC, PBS+LPS group; AKK, *A. muciniphila* + LPS group. $n=8$ each group.



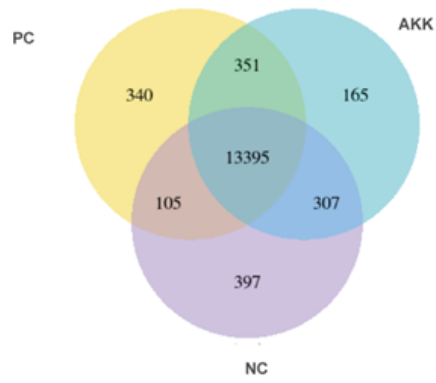
Supplementary Figure 3 A. *muciniphila* load in the feces was measured 21 days of gavage. Data are presented as the mean \pm SEM; Compared with the PC group, * $p < 0.05$. NC, PBS + saline group; PC, PBS+LPS group; AKK, *A. muciniphila* + LPS group. $n=8$ each group.



Supplementary Figure 4 LefSe analyses identified the differentially abundant taxa between the NC and PC groups (A) and the PC and AKK groups (B). NC, PBS + saline group; PC, PBS+LPS group; AKK, *A. muciniphila* + LPS group. $n=4-5$ per group. LefSe, linear discriminant analysis effect size.



Supplementary Figure 5 Correlation analysis between gut microbiota and lung microbiota. Spearman's rho non parametric correlation was performed and significant relationships with $P < 0.05$ was showed. Dark green node: genus in gut microbiota. Orange node: genus in lung microbiota; The red line between nodes represents a positive relationship, while the green line represents a negative relationship.



Supplementary Figure 6 Venn diagram of three groups. 3-4 animals per group. NC, PBS + saline group; PC, PBS+LPS group; AKK, *A. muciniphila* + LPS group.