# Supplementary information

## Supplementary Tables

**Supplementary Table 1.** Demographics of the study participants (Mean ± Standard Deviation)

| Cohort | Factors | CRC | CRA | PP | HC | *p*-value |
|---|---|---|---|---|---|---|
| Cohort 1 | Size | 15 | 19 | 19 | 18 | |
| | Age | 62.05 ± 12.58 | 55.42 ± 10.47 | 55.80 ± 13.4 | 48.04 ± 5.82 | *p* = 0.09 |
| | Gender | Male: 9 Female: 6 | Male: 14 Female: 5 | Male: 14 Female: 5 | Male: 8 Female: 10 | *p* = 0.52 |
| | BMI | 23.08 ± 3.42 | 24.11 ± 4.12 | 23.87 ± 4.22 | 24.11 ± 3.02 | *p* = 0.32 |
| Cohort 2 | Size | 92 | 119 | 95 | 96 | |
| | Age | 62.19 ± 6.21 | 60.11 ± 4.77 | 61.11 ± 5.70 | 62.11 ± 5.32 | *p* = 0.19 |
| | Gender | Male: 49 Female: 43 | Male: 55 Female: 64 | Male: 46 Female: 51 | Male: 49 Female: 47 | *p* = 0.42 |
| | BMI | 23.81 ± 3.34 | 23.22 ± 3.16 | 24.51 ± 3.48 | 24.11 ± 3.38 | *p* = 0.35 |

**Supplementary Table 2.** qPCR primers and their sequences in this study

| Species | Upper primer sequence (5'-3') | Lower primer sequence (5'-3') |
|---|---|---|
| *Fusobacterium nucleatum* | CAACCATTACTTTAACTCTACCATGTTCA | GTTGACTTTACAGAAGGAGATTATGTAAAAATC |
| *Bifidobacterium bifidum* | CTTACTTCGCCTTCTTTGCTCCGTAC | AGAAGTCCAAGACTTTGGCCCTGA |
| *Candida albicans* | TTTATCATCTTGTCACAGCAGA | ATCCCGCCTTGCCACTACCG |
| *Saccharomyces cerevisiae* | AGGAGTGCGGCTCTTAG | TACTTACCGAGGCAAGCTCCA |
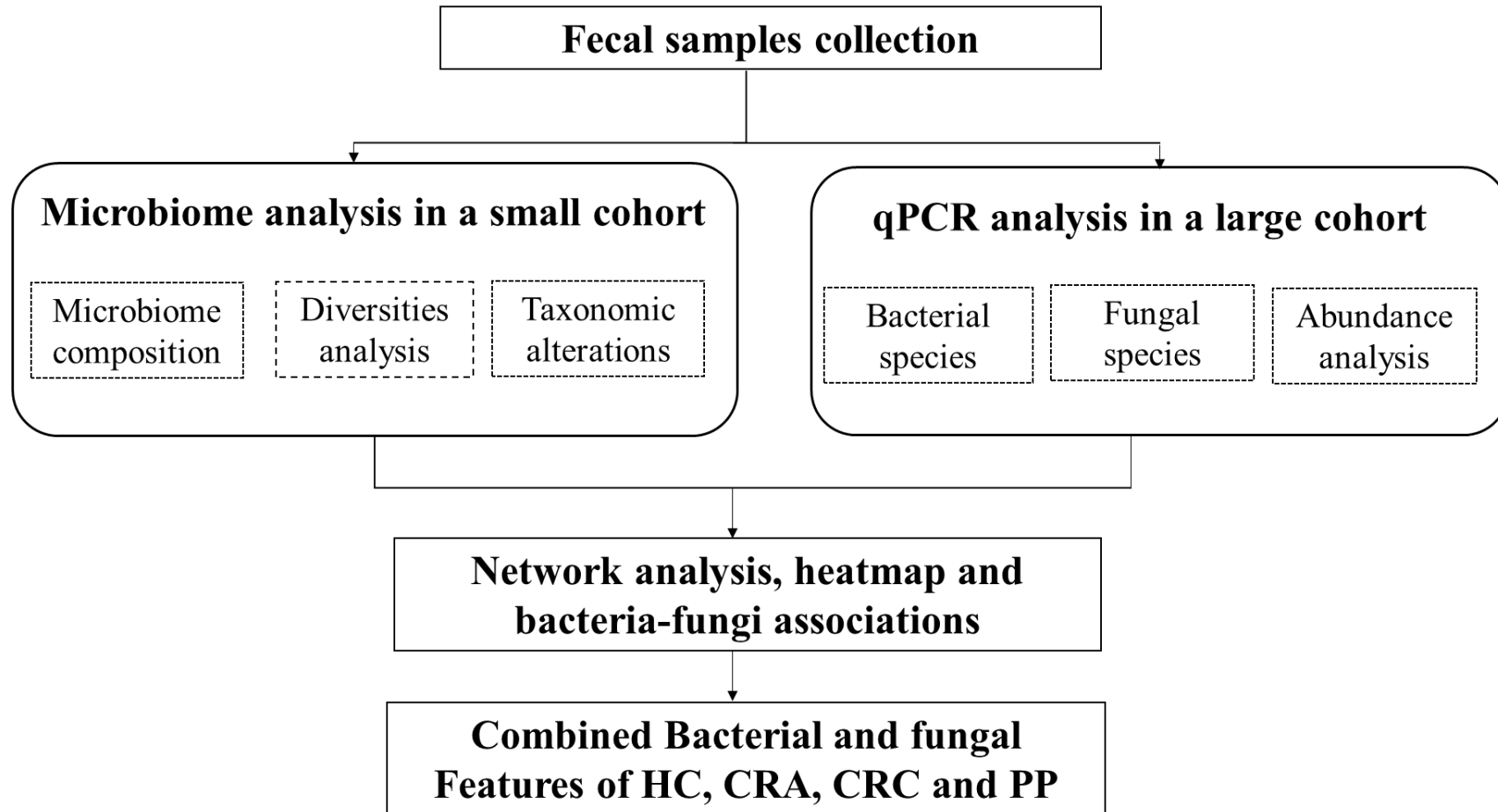
**Supplementary Figure 1.** Analysis flowchart of the study
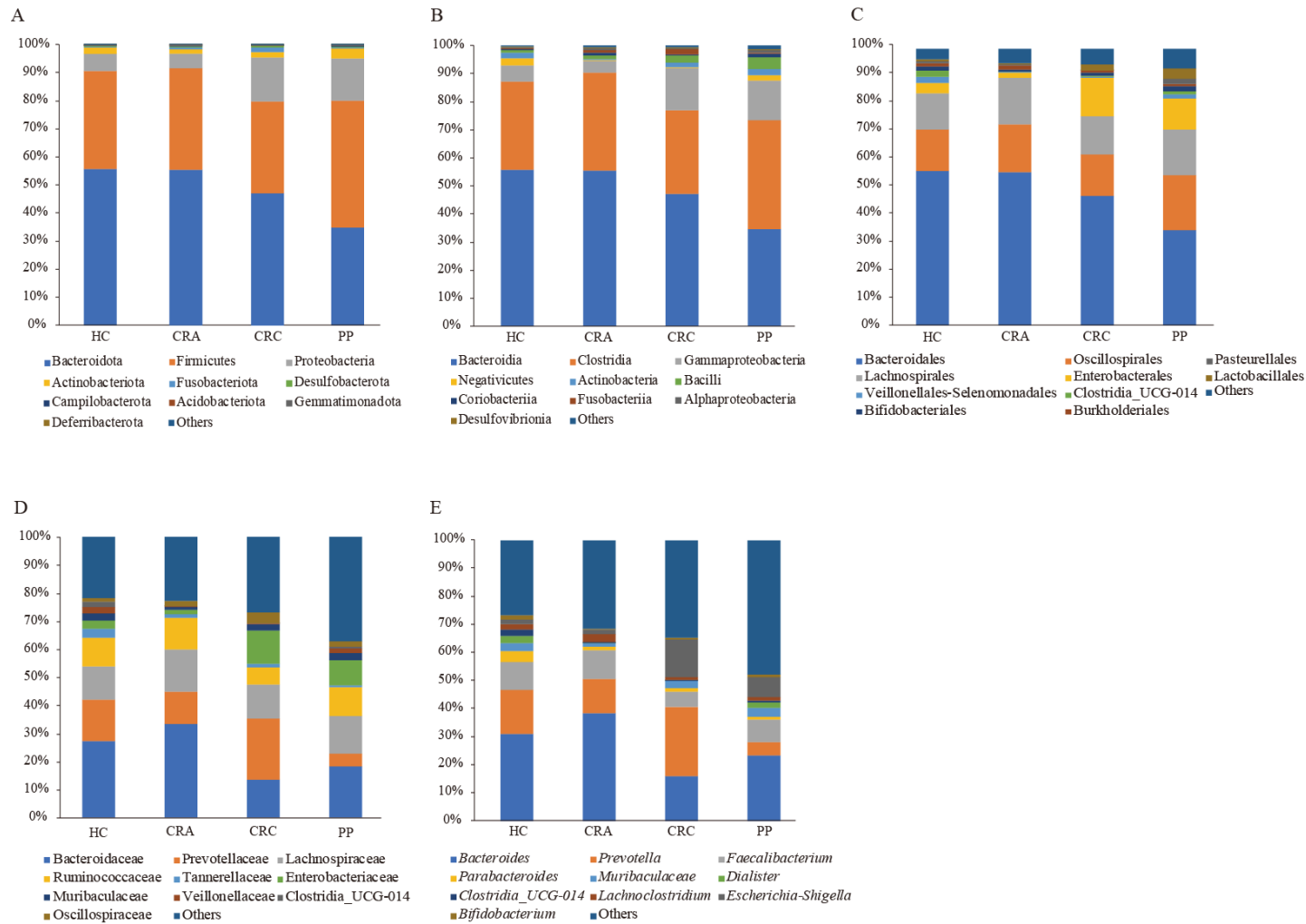
**Supplementary Figure 2.** Taxonomic analysis of gut bacteria from 16S rRNA sequencing. Compositions of gut bacteria of HC, CRA, CRC, and PP groups at phyla (A), classes (B), orders (C), families (D), and genera (E) levels.
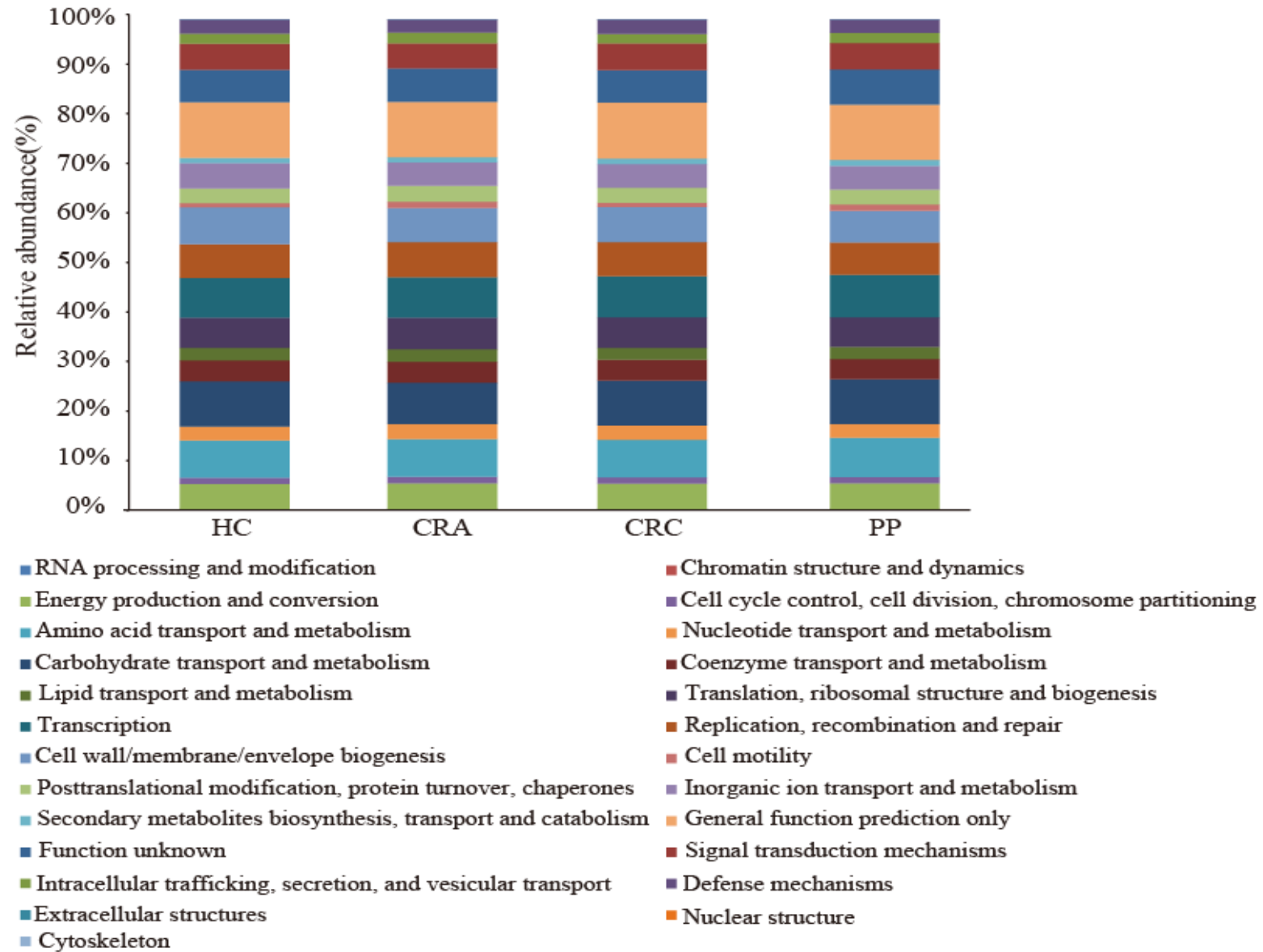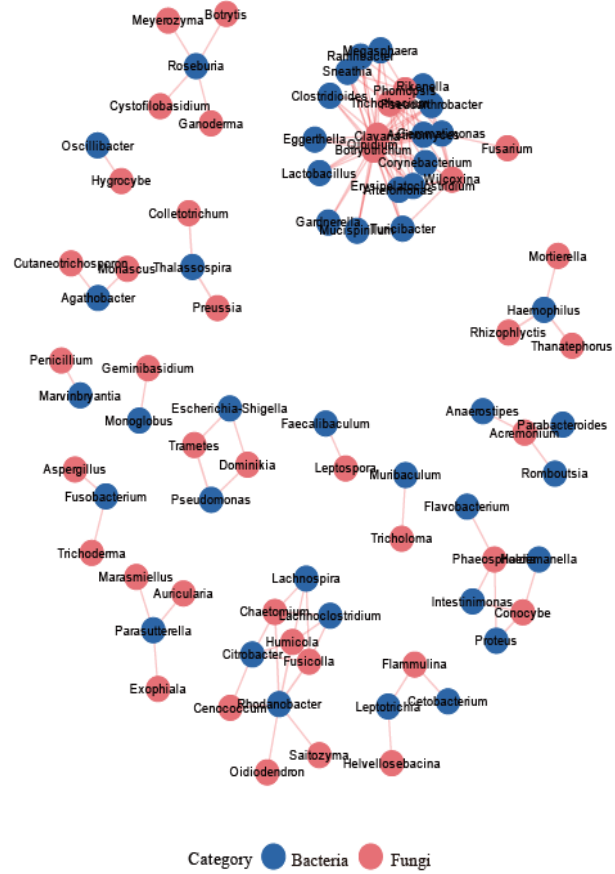
**Supplementary Figure 3.** Functional predictions for four groups based on PICRUSt analysis.
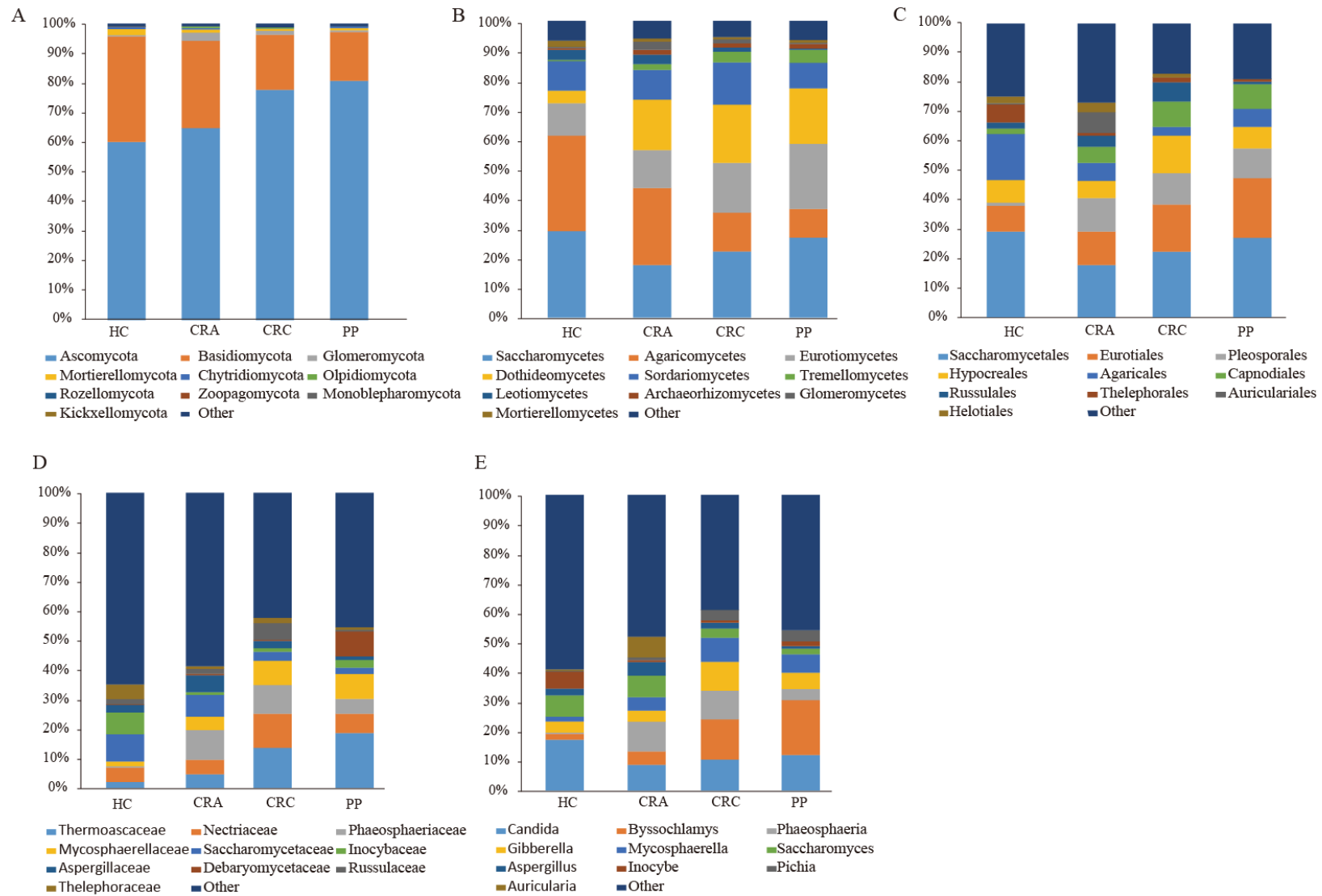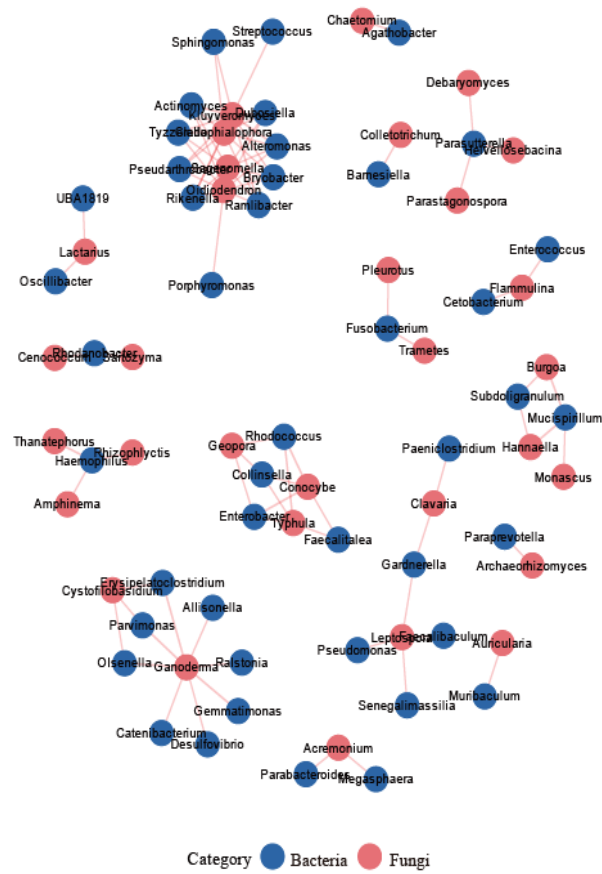
**Supplementary Figure 4.** Taxonomic analysis of gut fungi from ITS sequencing. Compositions of gut fungi of HC, CRA, CRC, and PP groups at phyla (A), classes (B), orders (C), families (D), and genera (E) levels.
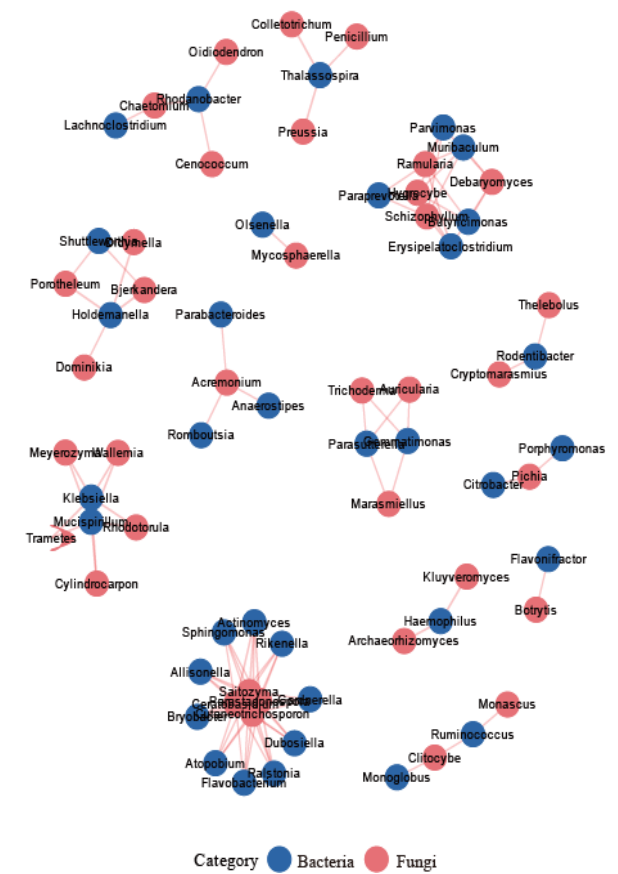
**Supplementary Figure 5.** Correlation network between bacteria and fungi in HC *vs.* CRC (A), HC *vs.* CRA (B), and HC *vs.* PP (C), respectively. Notes: blue circles: bacteria; red circles: fungi.