**Supplementary Table S1.** Relative fold differences of cytokines in OA Cases vs Controls. Fold-changes were calculated by normalizing the RFU for each cytokine in all groups by the average RFU for all controls. According to manufacturer’s analysis criteria, cytokine is significantly upregulated if **≥1.5-fold** and significantly downregulated if ≤ *0.65-fold*.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Cytokine** | **Cases (Women)** | | **Cases (Men)** | | **Controls (Women)** | | **Controls (Men)** | |
| **African American** | **Caucasian** | **African American** | **Caucasian** | **African American** | **Caucasian** | **African American** | **Caucasian** |
| **ENA-78** | **2.27** | **1.67** | 0.65 | *0.58* | **1.79** | 0.75 | 1.03 | *0.39* |
| **GCSF** | 0.86 | 1.00 | 1.11 | 0.97 | 1.09 | 0.95 | 0.86 | 1.03 |
| **GM-CSF** | 0.84 | 0.99 | 1.21 | 1.00 | 1.06 | 0.90 | 1.03 | 1.03 |
| **GRO** | 1.25 | 1.36 | **1.71** | 0.99 | 1.05 | 0.68 | 1.31 | 1.14 |
| **GRO-a** | 0.75 | 1.10 | **1.62** | 0.90 | 1.30 | 0.79 | 0.71 | 1.05 |
| **I-309** | 0.67 | **1.64** | **1.64** | 0.71 | **1.68** | 0.66 | 0.90 | 0.68 |
| **IL-1a** | 0.85 | 1.00 | 1.15 | 0.93 | 1.14 | 0.87 | 0.87 | 1.05 |
| **IL-1b** | *0.21* | **1.88** | *0.41* | 0.75 | **2.65** | *0.28* | *0.17* | *0.40* |
| **IL-2** | 0.77 | 1.09 | 1.16 | 0.89 | 1.30 | 0.86 | 0.88 | 0.88 |
| **IL-3** | 0.83 | 1.21 | 1.07 | 0.93 | 1.18 | 0.93 | 0.93 | 0.91 |
| **IL-4** | **2.65** | 1.43 | 0.92 | *0.59* | **1.87** | 0.66 | *0.63* | *0.60* |
| **IL-5** | 0.93 | 1.03 | 1.22 | 1.00 | 0.94 | 1.03 | 0.93 | 1.07 |
| **IL-6** | 0.91 | 1.03 | 1.17 | 1.06 | 1.04 | 1.00 | 0.85 | 1.04 |
| **IL-7** | 0.92 | 1.11 | 1.39 | 1.01 | 0.97 | 0.95 | 0.90 | 1.14 |
| **IL-8** | 0.85 | 1.05 | 1.21 | 1.02 | 0.99 | 0.98 | 0.86 | 1.10 |
| **IL-10** | 0.85 | 0.93 | 1.07 | 0.91 | 0.96 | 0.92 | 1.18 | 1.04 |
| **IL-12 p70** | 0.82 | 0.98 | 1.23 | 0.86 | 1.08 | 0.89 | 0.91 | 1.08 |
| **IL-13** | 0.91 | 1.04 | 1.23 | 1.04 | 1.00 | 1.00 | 0.92 | 1.04 |
| **IL-15** | 0.75 | 1.10 | 1.43 | 0.90 | 1.35 | 0.86 | *0.62* | 0.97 |
| **IFN- g** | 0.83 | 1.12 | 0.89 | 0.81 | 1.27 | 0.85 | 0.83 | 0.95 |
| **MCP-1** | 0.95 | 1.05 | 1.02 | 0.86 | 1.13 | 0.93 | 0.84 | 1.01 |
| **MCP-2** | 1.33 | 1.19 | 0.71 | 0.94 | 1.21 | 0.88 | 1.06 | 0.87 |
| **MCP-3** | 0.82 | **2.04** | 0.81 | 0.79 | **1.68** | 0.77 | *0.53* | 0.75 |
| **MCSF** | 1.04 | **1.99** | 1.08 | 1.17 | 0.99 | 0.99 | 1.00 | 1.02 |
| **MDC** | 1.00 | **2.05** | 1.08 | 0.70 | 1.09 | 0.97 | 0.86 | 1.00 |
| **MIG** | 0.74 | 1.20 | 1.20 | 0.94 | 0.96 | 0.98 | 0.88 | 1.13 |
| **MIP-1b** | **1.67** | 0.78 | **1.59** | *0.63* | 0.76 | 0.79 | 0.94 | **1.53** |
| **MIP-1d** | 1.24 | 0.90 | 0.99 | 0.85 | 1.11 | 0.95 | 0.86 | 0.99 |
| **RANTES** | 0.95 | 1.12 | 1.06 | 0.91 | 1.03 | 0.95 | 0.97 | 1.04 |
| **SCF** | 0.81 | 1.04 | 0.81 | 0.84 | 1.46 | 0.75 | 0.70 | 0.92 |
| **SDF-1** | 0.76 | 1.41 | 0.68 | 0.79 | **1.62** | 0.78 | *0.56* | 0.78 |
| **TARC** | 0.67 | 0.70 | **1.53** | 0.72 | 0.84 | 0.84 | 1.24 | 1.23 |
| **TGF-b1** | 0.82 | 0.98 | 1.24 | 1.45 | 0.85 | 0.91 | 1.45 | 1.04 |
| **TNF-a** | 0.79 | 1.15 | 1.20 | 0.87 | 1.20 | 0.92 | 0.85 | 0.94 |
| **TNF-b** | 0.78 | 1.00 | 1.19 | 0.87 | 1.23 | 0.89 | 0.89 | 0.92 |
| **EGF** | 0.99 | 1.15 | **4.69** | 0.84 | 1.30 | 1.10 | 0.68 | 0.72 |
| **IGF-I** | 0.96 | 1.10 | **1.51** | 0.82 | 1.04 | 0.94 | 0.92 | 1.06 |
| **Angiogenin** | 0.88 | 1.04 | 1.47 | 0.95 | 0.90 | 0.98 | 0.92 | 1.17 |
| **Oncostatin M** | 1.08 | **1.62** | 1.25 | 1.04 | 0.96 | 1.03 | 0.85 | 1.08 |
| **Thrombopoietin** | 0.85 | **1.75** | 1.37 | 0.82 | 1.21 | 0.72 | 1.31 | 0.92 |
| **VEGF** | *0.61* | 1.13 | 1.33 | 0.81 | 1.03 | 1.07 | 0.79 | 1.00 |
| **PDGF-BB** | 0.86 | 1.16 | 1.30 | 1.17 | 1.03 | 0.87 | 0.82 | 1.21 |
| **Leptin** | 1.08 | 1.17 | 0.69 | *0.60* | 1.10 | 1.26 | *0.49* | 0.87 |
| **BDNF** | 0.90 | 1.31 | 1.28 | 0.74 | 1.14 | 0.79 | 1.21 | 0.97 |
| **BLC** | *0.61* | 0.79 | 1.26 | *0.53* | 0.66 | 0.76 | **2.92** | 0.68 |
| **Ck b 8-1** | *0.48* | **8.51** | *0.55* | 0.93 | **2.10** | *0.54* | *0.43* | *0.58* |
| **Eotaxin** | 0.91 | 0.83 | 1.05 | 0.88 | 0.94 | 1.03 | 0.68 | 1.19 |
| **Eotaxin-2** | 0.68 | 1.19 | *0.53* | 1.26 | 0.77 | 1.20 | 0.89 | 1.09 |
| **Eotaxin-3** | 0.86 | **1.91** | 1.27 | 0.88 | 1.08 | 0.96 | 0.91 | 1.01 |
| **FGF-4** | *0.23* | **2.47** | *0.27* | *0.40* | **2.17** | *0.37* | *0.53* | *0.64* |
| **FGF-6** | 0.78 | **2.35** | 1.12 | 0.86 | 1.48 | 0.81 | 0.68 | 0.84 |
| **FGF-7** | *0.60* | **2.15** | *0.65* | 0.79 | **1.73** | 0.71 | *0.53* | 0.75 |
| **FGF-9** | *0.65* | **4.43** | 1.48 | 1.02 | 1.24 | 0.92 | 0.75 | 0.96 |
| **Flt-3 Ligand** | 0.81 | 1.05 | 1.45 | 0.82 | 0.65 | 1.15 | 1.00 | 1.22 |
| **Fractalkine** | *0.59* | 1.15 | *0.37* | *0.51* | **2.46** | *0.34* | *0.35* | *0.44* |
| **GCP-2** | *0.53* | 1.16 | 0.65 | 0.74 | **2.02** | *0.55* | *0.49* | *0.63* |
| **GDNF** | *0.62* | 0.87 | 1.04 | 0.90 | **1.60** | 0.79 | *0.62* | 0.76 |
| **HGF** | 1.05 | 1.36 | 1.11 | 0.89 | 1.14 | 1.01 | 0.74 | 0.97 |
| **IGFBP-1** | 1.47 | **1.58** | 1.01 | 1.00 | 0.86 | 1.25 | 0.72 | 1.03 |
| **IGFBP-2** | 1.00 | 1.09 | 1.11 | 0.95 | 0.88 | 1.04 | 0.97 | 1.10 |
| **IGFBP-3** | 1.06 | 0.99 | 0.98 | 0.99 | 0.70 | 1.09 | 0.93 | 1.27 |
| **IGFBP-4** | **2.44** | 1.21 | 0.67 | 0.87 | 1.43 | 0.92 | *0.47* | 0.88 |
| **IL-16** | 0.96 | **1.64** | 1.32 | 0.76 | **1.75** | *0.64* | 0.80 | 0.68 |
| **IP-10** | 0.72 | 1.03 | **2.46** | *0.65* | 1.05 | 0.91 | 1.35 | 0.87 |
| **LIF** | 0.80 | **1.55** | 1.18 | 0.89 | 1.12 | 1.05 | 0.75 | 0.94 |
| **LIGHT** | *0.21* | **1.70** | *0.37* | *0.51* | **2.64** | *0.33* | *0.28* | *0.30* |
| **MCP-4** | 0.81 | 0.74 | **1.55** | *0.57* | 1.15 | 0.68 | 0.92 | 1.22 |
| **MIF** | 0.87 | 1.33 | **1.58** | 0.82 | 1.24 | 0.91 | 0.74 | 0.97 |
| **MIP-3 a** | 1.22 | 0.71 | 0.84 | *0.25* | **1.64** | 0.84 | *0.29* | 0.83 |
| **NAP-2** | 1.01 | 0.95 | 0.99 | 0.91 | 1.10 | 0.95 | 0.90 | 1.00 |
| **NT-3** | 0.87 | 1.06 | 1.29 | 0.92 | 1.22 | 0.92 | 0.78 | 0.95 |
| **NT-4** | *0.58* | 1.27 | *0.58* | 0.85 | **1.84** | 0.74 | *0.50* | *0.61* |
| **Osteopontin** | **1.72** | 1.35 | **2.34** | 1.22 | 1.29 | 0.89 | 0.89 | 0.85 |
| **Osteoprotegerin** | 0.87 | 0.96 | 1.25 | 1.04 | 1.38 | 0.88 | 0.77 | 0.83 |
| **PARC** | 0.89 | 1.07 | 0.78 | 1.12 | 1.02 | 1.11 | 0.99 | 0.86 |
| **PIGF** | 0.68 | 1.23 | 1.12 | 0.88 | 1.38 | 0.83 | 0.80 | 0.87 |
| **TGF- b 2** | 0.84 | 1.12 | 1.47 | 0.95 | 1.00 | 0.99 | 0.93 | 1.05 |
| **TGF- b 3** | *0.34* | 0.74 | 1.49 | 1.02 | **2.45** | *0.30* | 0.70 | *0.32* |
| **TIMP-1** | 0.94 | 0.97 | 1.21 | 1.00 | 0.93 | 1.06 | 0.95 | 1.04 |
| **TIMP-2** | 1.22 | 0.90 | **1.68** | 1.16 | 1.00 | 1.07 | 1.15 | 0.85 |

**Supplementary Table S2.** Demographic and radiographic results for donors from which fecal samples were used for transplant to germ-free mice.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Age** | **Gender** | **Race** | **Group** | **BMI** | **KL grade Right** | **KL grade Left** | **Hand OA** |
| 85 | F | B | case | 37 | 2 | 3 | yes |
| 77 | M | W | case | 30 | 3 | 1 | yes |
| 72 | F | B | case | 38 | Replaced | 4 | yes |
| 70 | M | W | case | 42 | 4 | 4 | yes |
| 69 | F | W | case | 39 | 4 | 3 | yes |
| 70 | F | W | control | 40 | 1 | 1 | no |
| 68 | F | W | control | 33 | 1 | 1 | no |
| 67 | F | B | control | 39 | 1 | 1 | no |
| 64 | F | W | control | 28 | 1 | 0 | no |
| 80 | M | W | control | 32 | 1 | 2 | no |

**Supplementary Table S3.** Univariate and Multivariable Associations of Participant Characteristics and OA status with Gut Microbial alpha-diversity (Shannon index)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Univariate model** | | **Multivariable Model** | |
|  | beta coefficient (SE) | p-value | beta coefficient (SE) | p-value |
| Female gender | -0.24 (0.13) | 0.07 | -0.19 (0.14) | 0.18 |
| Age | 0.01 (0.01) | 0.19 | 0.01(0.01) | 0.2 |
| BMI | -0.04 (0.01) | 0.01 | -0.03 (0.20) | 0.11 |
| Presence of knee and hand OA | -0.12 (0.12) | 0.29 | -0.03 (0.13) | 0.75 |

BMI, body mass index; SE, Standard Error

**Supplementary Table S4.** Relative abundance of genera in female (N=69) and male (N=23) JoCo OA participants. P: p-values from the non-parametric Wilcoxon test; Q: false discovery rate adjusted p-values; SD: standard deviation.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | ALL | | FEMALES (N=69) | | MALES  (N=23) | |  |  |
| Taxon name | mean | sd | mean | sd | mean | sd | P | Q |
| k\_\_Archaea.p\_\_Euryarchaeota.c\_\_Methanobacteria.o\_\_Methanobacteriales.  f\_\_Methanobacteriaceae.g\_\_Methanobrevibacter | 1.29E-03 | 6.27E-03 | 6.94E-04 | 2.86E-03 | 3.08E-03 | 1.15E-02 | 0.18 | 0.68 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Actinobacteria.o\_\_Actinomycetales.  f\_\_Actinomycetaceae.g\_\_Actinomyces | 1.70E-04 | 3.82E-04 | 1.38E-04 | 3.07E-04 | 2.65E-04 | 5.47E-04 | 0.13 | 0.61 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Actinobacteria.o\_\_Actinomycetales.  f\_\_Micrococcaceae.g\_\_Rothia | 5.03E-05 | 1.28E-04 | 4.98E-05 | 1.42E-04 | 5.15E-05 | 7.76E-05 | 0.24 | 0.68 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Actinobacteria.o\_\_Bifidobacteriales.  f\_\_Bifidobacteriaceae.g\_\_Bifidobacterium | 3.56E-03 | 8.06E-03 | 3.38E-03 | 8.54E-03 | 4.11E-03 | 6.58E-03 | 0.08 | 0.53 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_ | 1.34E-03 | 4.08E-03 | 9.32E-04 | 1.70E-03 | 2.56E-03 | 7.60E-03 | 0.31 | 0.75 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_Adlercreutzia | 9.21E-04 | 1.97E-03 | 7.74E-04 | 1.48E-03 | 1.36E-03 | 2.98E-03 | 0.38 | 0.78 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_Atopobium | 1.73E-05 | 4.25E-05 | 1.88E-05 | 4.73E-05 | 1.29E-05 | 2.25E-05 | 0.78 | 0.93 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_Collinsella | 3.41E-03 | 6.54E-03 | 3.61E-03 | 6.92E-03 | 2.80E-03 | 5.32E-03 | 0.60 | 0.93 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_Eggerthella | 2.23E-04 | 5.81E-04 | 1.86E-04 | 4.44E-04 | 3.36E-04 | 8.77E-04 | 0.93 | 0.99 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_Slackia | 1.09E-04 | 3.95E-04 | 8.55E-05 | 3.71E-04 | 1.80E-04 | 4.63E-04 | 0.20 | 0.68 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_Bacteroidaceae.g\_\_Bacteroides | 3.99E-01 | 2.25E-01 | 4.17E-01 | 2.31E-01 | 3.45E-01 | 2.02E-01 | 0.23 | 0.68 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_Porphyromonadaceae.g\_\_Parabacteroides | 2.58E-02 | 1.95E-02 | 2.52E-02 | 1.88E-02 | 2.75E-02 | 2.17E-02 | 0.75 | 0.93 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_Prevotellaceae.g\_\_Prevotella | 3.65E-02 | 1.02E-01 | 3.91E-02 | 1.10E-01 | 2.85E-02 | 7.56E-02 | 0.40 | 0.78 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_Rikenellaceae.g\_\_ | 1.84E-02 | 2.77E-02 | 1.53E-02 | 2.05E-02 | 2.75E-02 | 4.20E-02 | 0.50 | 0.87 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_S24.7.g\_\_ | 1.93E-03 | 1.05E-02 | 3.01E-04 | 1.75E-03 | 6.82E-03 | 2.03E-02 | 0.02 | 0.44 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_.Barnesiellaceae..g\_\_ | 3.16E-03 | 7.09E-03 | 3.68E-03 | 7.92E-03 | 1.60E-03 | 3.25E-03 | 0.80 | 0.93 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_.Odoribacteraceae..g\_\_Butyricimonas | 3.32E-03 | 4.57E-03 | 2.95E-03 | 3.75E-03 | 4.45E-03 | 6.41E-03 | 0.64 | 0.93 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_.Odoribacteraceae..g\_\_Odoribacter | 4.65E-03 | 7.95E-03 | 5.66E-03 | 8.86E-03 | 1.61E-03 | 2.36E-03 | 0.03 | 0.51 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_.Paraprevotellaceae..g\_\_Paraprevotella | 3.37E-03 | 1.68E-02 | 4.34E-03 | 1.94E-02 | 4.40E-04 | 1.54E-03 | 0.23 | 0.68 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_.Paraprevotellaceae..g\_\_.Prevotella. | 1.22E-03 | 5.92E-03 | 6.02E-04 | 3.07E-03 | 3.09E-03 | 1.05E-02 | 0.87 | 0.99 |
| k\_\_Bacteria.p\_\_Cyanobacteria.c\_\_4C0d.2.o\_\_YS2.  f\_\_.g\_\_ | 2.64E-03 | 1.24E-02 | 1.40E-03 | 8.62E-03 | 6.35E-03 | 1.96E-02 | 0.06 | 0.51 |
| k\_\_Bacteria.p\_\_Cyanobacteria.c\_\_Chloroplast.o\_\_Streptophyta.f\_\_.g\_\_ | 3.57E-05 | 2.38E-04 | 1.04E-05 | 2.49E-05 | 1.11E-04 | 4.74E-04 | 0.16 | 0.68 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Gemellales.  f\_\_Gemellaceae.g\_\_ | 2.94E-05 | 8.88E-05 | 2.60E-05 | 8.84E-05 | 3.97E-05 | 9.12E-05 | 0.11 | 0.61 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Lactobacillales.Other.Other | 6.85E-05 | 1.51E-04 | 5.48E-05 | 9.58E-05 | 1.10E-04 | 2.53E-04 | 0.79 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Lactobacillales.  f\_\_Enterococcaceae.g\_\_Enterococcus | 2.68E-05 | 8.77E-05 | 1.73E-05 | 4.46E-05 | 5.50E-05 | 1.57E-04 | 1.00 | 1.00 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Lactobacillales.  f\_\_Lactobacillaceae.g\_\_Lactobacillus | 3.11E-03 | 1.76E-02 | 3.45E-03 | 2.02E-02 | 2.09E-03 | 5.06E-03 | 0.12 | 0.61 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Lactobacillales.  f\_\_Leuconostocaceae.g\_\_ | 1.96E-04 | 8.89E-04 | 9.51E-05 | 4.10E-04 | 4.98E-04 | 1.62E-03 | 0.71 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Lactobacillales.  f\_\_Streptococcaceae.g\_\_Lactococcus | 1.37E-04 | 5.07E-04 | 1.58E-04 | 5.80E-04 | 7.35E-05 | 1.29E-04 | 0.75 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Lactobacillales.  f\_\_Streptococcaceae.g\_\_Streptococcus | 6.91E-03 | 1.36E-02 | 5.08E-03 | 1.08E-02 | 1.24E-02 | 1.90E-02 | 0.08 | 0.53 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Turicibacterales.  f\_\_Turicibacteraceae.g\_\_Turicibacter | 3.79E-04 | 2.51E-03 | 1.19E-04 | 4.85E-04 | 1.16E-03 | 4.94E-03 | 0.67 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.Other.Other.Other | 1.26E-04 | 4.46E-04 | 1.48E-04 | 5.11E-04 | 5.91E-05 | 9.19E-05 | 0.22 | 0.68 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.Other.Other | 9.42E-04 | 1.51E-03 | 9.14E-04 | 1.69E-03 | 1.02E-03 | 7.93E-04 | 0.09 | 0.53 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_.g\_\_ | 3.63E-02 | 3.45E-02 | 3.52E-02 | 3.52E-02 | 3.96E-02 | 3.28E-02 | 0.34 | 0.76 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Christensenellaceae.g\_\_ | 2.60E-03 | 6.65E-03 | 2.96E-03 | 7.58E-03 | 1.51E-03 | 1.81E-03 | 0.33 | 0.75 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Christensenellaceae.g\_\_Christensenella | 3.00E-05 | 6.21E-05 | 2.88E-05 | 6.08E-05 | 3.35E-05 | 6.73E-05 | 0.60 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Clostridiaceae.g\_\_ | 1.64E-03 | 4.46E-03 | 8.59E-04 | 1.48E-03 | 3.98E-03 | 8.25E-03 | 0.01 | 0.44 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Clostridiaceae.g\_\_Clostridium | 9.49E-04 | 2.15E-03 | 8.19E-04 | 1.78E-03 | 1.34E-03 | 3.04E-03 | 0.06 | 0.51 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Dehalobacteriaceae.g\_\_Dehalobacterium | 1.61E-04 | 3.32E-04 | 1.60E-04 | 3.65E-04 | 1.65E-04 | 2.11E-04 | 0.02 | 0.44 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_EtOH8.g\_\_ | 3.29E-05 | 1.32E-04 | 1.95E-05 | 5.59E-05 | 7.29E-05 | 2.46E-04 | 0.74 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Eubacteriaceae.g\_\_Anaerofustis | 3.01E-05 | 6.74E-05 | 2.52E-05 | 4.61E-05 | 4.47E-05 | 1.09E-04 | 0.74 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Eubacteriaceae.g\_\_Pseudoramibacter\_Eubacterium | 7.66E-05 | 3.70E-04 | 5.16E-05 | 2.53E-04 | 1.52E-04 | 6.01E-04 | 0.36 | 0.77 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.Other | 1.08E-02 | 1.33E-02 | 9.68E-03 | 1.33E-02 | 1.41E-02 | 1.30E-02 | 0.04 | 0.51 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_ | 5.21E-02 | 4.08E-02 | 4.85E-02 | 4.04E-02 | 6.27E-02 | 4.11E-02 | 0.06 | 0.51 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Anaerostipes | 8.91E-04 | 1.52E-03 | 9.24E-04 | 1.67E-03 | 7.94E-04 | 9.64E-04 | 0.44 | 0.79 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Blautia | 1.85E-02 | 2.09E-02 | 1.83E-02 | 2.15E-02 | 1.88E-02 | 1.92E-02 | 0.31 | 0.75 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Coprococcus | 9.30E-03 | 1.15E-02 | 8.49E-03 | 1.16E-02 | 1.17E-02 | 1.13E-02 | 0.13 | 0.61 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Dorea | 5.78E-03 | 7.71E-03 | 5.38E-03 | 7.53E-03 | 6.99E-03 | 8.27E-03 | 0.07 | 0.51 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Lachnobacterium | 9.90E-04 | 3.77E-03 | 5.31E-04 | 1.56E-03 | 2.37E-03 | 6.97E-03 | 0.21 | 0.68 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Lachnospira | 9.20E-03 | 1.08E-02 | 8.56E-03 | 1.07E-02 | 1.11E-02 | 1.12E-02 | 0.33 | 0.75 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Roseburia | 1.30E-03 | 1.51E-03 | 1.23E-03 | 1.42E-03 | 1.51E-03 | 1.77E-03 | 0.24 | 0.68 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_.Ruminococcus. | 8.21E-03 | 9.91E-03 | 7.29E-03 | 6.58E-03 | 1.10E-02 | 1.62E-02 | 0.45 | 0.80 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Peptococcaceae.g\_\_ | 9.25E-05 | 2.77E-04 | 8.19E-05 | 2.15E-04 | 1.24E-04 | 4.15E-04 | 0.53 | 0.89 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Peptococcaceae.g\_\_rc4.4 | 1.74E-04 | 6.22E-04 | 1.31E-04 | 3.77E-04 | 3.00E-04 | 1.07E-03 | 0.19 | 0.68 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Peptostreptococcaceae.g\_\_ | 7.65E-05 | 3.65E-04 | 7.42E-05 | 3.96E-04 | 8.33E-05 | 2.58E-04 | 0.66 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.Other | 1.80E-04 | 6.55E-04 | 1.55E-04 | 5.80E-04 | 2.57E-04 | 8.52E-04 | 0.41 | 0.78 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.g\_\_ | 4.89E-02 | 4.66E-02 | 4.46E-02 | 3.99E-02 | 6.20E-02 | 6.20E-02 | 0.36 | 0.77 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.g\_\_Anaerotruncus | 4.99E-04 | 1.61E-03 | 5.77E-04 | 1.85E-03 | 2.67E-04 | 3.46E-04 | 0.41 | 0.78 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.g\_\_Faecalibacterium | 3.68E-02 | 5.29E-02 | 3.89E-02 | 5.93E-02 | 3.05E-02 | 2.53E-02 | 0.55 | 0.91 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.g\_\_Oscillospira | 1.64E-02 | 1.20E-02 | 1.69E-02 | 1.16E-02 | 1.48E-02 | 1.32E-02 | 0.19 | 0.68 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.g\_\_Ruminococcus | 2.42E-02 | 2.85E-02 | 2.32E-02 | 2.89E-02 | 2.72E-02 | 2.74E-02 | 0.40 | 0.78 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_Acidaminococcus | 1.12E-02 | 3.42E-02 | 1.31E-02 | 3.75E-02 | 5.50E-03 | 2.08E-02 | 1.00 | 1.00 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_Dialister | 9.49E-03 | 2.54E-02 | 5.84E-03 | 1.37E-02 | 2.04E-02 | 4.39E-02 | 0.31 | 0.75 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_Megasphaera | 8.96E-03 | 2.70E-02 | 1.08E-02 | 2.99E-02 | 3.34E-03 | 1.45E-02 | 0.79 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_Phascolarctobacterium | 4.21E-02 | 5.98E-02 | 4.69E-02 | 6.65E-02 | 2.78E-02 | 2.85E-02 | 0.61 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_Veillonella | 4.43E-03 | 1.68E-02 | 3.63E-03 | 1.39E-02 | 6.85E-03 | 2.38E-02 | 0.27 | 0.72 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_.Mogibacteriaceae..g\_\_ | 7.64E-04 | 1.28E-03 | 7.60E-04 | 1.37E-03 | 7.75E-04 | 9.89E-04 | 0.73 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Erysipelotrichi.o\_\_Erysipelotrichales.  f\_\_Erysipelotrichaceae.g\_\_ | 1.12E-03 | 2.69E-03 | 1.29E-03 | 3.05E-03 | 6.07E-04 | 9.17E-04 | 0.98 | 1.00 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Erysipelotrichi.o\_\_Erysipelotrichales.  f\_\_Erysipelotrichaceae.g\_\_Coprobacillus | 3.05E-04 | 9.56E-04 | 3.41E-04 | 1.07E-03 | 1.97E-04 | 4.77E-04 | 0.21 | 0.68 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Erysipelotrichi.o\_\_Erysipelotrichales.  f\_\_Erysipelotrichaceae.g\_\_Holdemania | 3.02E-04 | 5.06E-04 | 2.66E-04 | 4.34E-04 | 4.10E-04 | 6.79E-04 | 0.25 | 0.68 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Erysipelotrichi.o\_\_Erysipelotrichales.  f\_\_Erysipelotrichaceae.g\_\_.Eubacterium. | 1.19E-03 | 3.14E-03 | 1.19E-03 | 3.41E-03 | 1.18E-03 | 2.21E-03 | 0.61 | 0.93 |
| k\_\_Bacteria.p\_\_Fusobacteria.c\_\_Fusobacteriia.o\_\_Fusobacteriales.  f\_\_Fusobacteriaceae.g\_\_Fusobacterium | 4.68E-03 | 2.67E-02 | 3.79E-03 | 2.59E-02 | 7.34E-03 | 2.94E-02 | 0.89 | 0.99 |
| k\_\_Bacteria.p\_\_Lentisphaerae.c\_\_.Lentisphaeria..o\_\_Victivallales.  f\_\_Victivallaceae.g\_\_ | 9.57E-04 | 4.86E-03 | 1.22E-03 | 5.60E-03 | 1.78E-04 | 4.56E-04 | 0.79 | 0.93 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Alphaproteobacteria.o\_\_RF32.f\_\_.g\_\_ | 2.33E-03 | 9.47E-03 | 1.98E-03 | 1.01E-02 | 3.35E-03 | 7.46E-03 | 0.02 | 0.44 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Betaproteobacteria.o\_\_Burkholderiales.  f\_\_Alcaligenaceae.g\_\_Sutterella | 1.68E-02 | 1.82E-02 | 1.73E-02 | 1.91E-02 | 1.53E-02 | 1.55E-02 | 0.77 | 0.93 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Betaproteobacteria.o\_\_Burkholderiales.  f\_\_Oxalobacteraceae.g\_\_Oxalobacter | 8.87E-05 | 1.75E-04 | 8.45E-05 | 1.73E-04 | 1.01E-04 | 1.83E-04 | 0.56 | 0.91 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Deltaproteobacteria.o\_\_Desulfovibrionales.  f\_\_Desulfovibrionaceae.g\_\_ | 3.66E-04 | 1.50E-03 | 3.02E-04 | 1.03E-03 | 5.59E-04 | 2.44E-03 | 0.94 | 0.99 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Deltaproteobacteria.o\_\_Desulfovibrionales.  f\_\_Desulfovibrionaceae.g\_\_Bilophila | 2.55E-03 | 3.48E-03 | 2.62E-03 | 3.73E-03 | 2.35E-03 | 2.63E-03 | 0.67 | 0.93 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Deltaproteobacteria.o\_\_Desulfovibrionales.  f\_\_Desulfovibrionaceae.g\_\_Desulfovibrio | 9.06E-04 | 2.37E-03 | 7.32E-04 | 1.93E-03 | 1.43E-03 | 3.38E-03 | 0.29 | 0.75 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Epsilonproteobacteria.o\_\_Campylobacterales.  f\_\_Campylobacteraceae.g\_\_Campylobacter | 5.25E-05 | 2.31E-04 | 5.53E-05 | 2.56E-04 | 4.41E-05 | 1.37E-04 | 0.14 | 0.63 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Enterobacteriales.  f\_\_Enterobacteriaceae.Other | 1.12E-04 | 2.74E-04 | 1.08E-04 | 2.90E-04 | 1.23E-04 | 2.25E-04 | 0.74 | 0.93 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Enterobacteriales.  f\_\_Enterobacteriaceae.g\_\_ | 4.16E-02 | 8.32E-02 | 3.65E-02 | 7.07E-02 | 5.67E-02 | 1.14E-01 | 0.94 | 0.99 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Enterobacteriales.  f\_\_Enterobacteriaceae.g\_\_Citrobacter | 2.01E-04 | 1.73E-03 | 2.56E-04 | 1.99E-03 | 3.85E-05 | 1.27E-04 | 0.89 | 0.99 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Enterobacteriales.  f\_\_Enterobacteriaceae.g\_\_Enterobacter | 9.33E-05 | 2.93E-04 | 7.78E-05 | 2.50E-04 | 1.40E-04 | 3.98E-04 | 0.84 | 0.97 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Enterobacteriales.  f\_\_Enterobacteriaceae.g\_\_Serratia | 1.38E-04 | 1.09E-03 | 1.65E-04 | 1.25E-03 | 5.57E-05 | 1.95E-04 | 0.49 | 0.85 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Pasteurellales.  f\_\_Pasteurellaceae.g\_\_Haemophilus | 1.08E-03 | 3.98E-03 | 7.71E-04 | 3.90E-03 | 2.02E-03 | 4.15E-03 | 0.06 | 0.51 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Pseudomonadales.  f\_\_Pseudomonadaceae.g\_\_Pseudomonas | 8.74E-05 | 2.79E-04 | 7.40E-05 | 2.73E-04 | 1.28E-04 | 2.99E-04 | 0.73 | 0.93 |
| k\_\_Bacteria.p\_\_Synergistetes.c\_\_Synergistia.o\_\_Synergistales.  f\_\_Dethiosulfovibrionaceae.g\_\_Pyramidobacter | 1.24E-03 | 8.19E-03 | 1.65E-03 | 9.43E-03 | 1.96E-05 | 2.73E-05 | 0.02 | 0.44 |
| k\_\_Bacteria.p\_\_Synergistetes.c\_\_Synergistia.o\_\_Synergistales.  f\_\_Synergistaceae.Other | 6.47E-04 | 2.60E-03 | 5.57E-04 | 1.87E-03 | 9.18E-04 | 4.13E-03 | 0.92 | 0.99 |
| k\_\_Bacteria.p\_\_TM7.c\_\_TM7.3.o\_\_.f\_\_.g\_\_ | 2.14E-05 | 5.27E-05 | 1.91E-05 | 4.81E-05 | 2.84E-05 | 6.52E-05 | 0.99 | 1.00 |
| k\_\_Bacteria.p\_\_Tenericutes.c\_\_Mollicutes.o\_\_RF39.f\_\_.g\_\_ | 2.47E-03 | 1.39E-02 | 3.21E-03 | 1.60E-02 | 2.64E-04 | 9.44E-04 | 1.00 | 1.00 |
| k\_\_Bacteria.p\_\_Verrucomicrobia.c\_\_Verrucomicrobiae.o\_\_Verrucomicrobiales.  f\_\_Verrucomicrobiaceae.g\_\_Akkermansia | 2.43E-02 | 6.28E-02 | 2.81E-02 | 7.07E-02 | 1.30E-02 | 2.65E-02 | 0.42 | 0.78 |

**Supplementary Table S5.** Relative abundance of genera in JoCo OA participants who did not have any knee pain or had only mild symptoms (WOMAC pain score <=5, N=62) versus those who had at least moderate symptoms (WOMAC > 5, N=30). P: p-values from the non-parametric Wilcoxon test; Q: false discovery rate adjusted p-values; SD: standard deviation.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | ALL | | WOMAC PAIN <= 5  (N=62) | | WOMAC PAIN > 5  (N=30) | |  |  |
| Taxon name | mean | SD | mean | SD | mean | SD | P | Q |
| k\_\_Archaea.p\_\_Euryarchaeota.c\_\_Methanobacteria.o\_\_Methanobacteriales.  f\_\_Methanobacteriaceae.g\_\_Methanobrevibacter | 1.27E-03 | 6.16E-03 | 1.61E-03 | 7.44E-03 | 5.46E-04 | 1.36E-03 | 0.82 | 0.97 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Actinobacteria.o\_\_Actinomycetales.  f\_\_Actinomycetaceae.g\_\_Actinomyces | 1.70E-04 | 3.80E-04 | 1.61E-04 | 3.60E-04 | 1.90E-04 | 4.22E-04 | 0.96 | 0.98 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Actinobacteria.o\_\_Actinomycetales.  f\_\_Micrococcaceae.g\_\_Rothia | 5.01E-05 | 1.27E-04 | 6.48E-05 | 1.51E-04 | 1.98E-05 | 3.33E-05 | 0.40 | 0.93 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Actinobacteria.o\_\_Bifidobacteriales.  f\_\_Bifidobacteriaceae.g\_\_Bifidobacterium | 3.54E-03 | 7.94E-03 | 2.52E-03 | 4.85E-03 | 5.65E-03 | 1.19E-02 | 0.84 | 0.97 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_ | 1.34E-03 | 4.04E-03 | 1.40E-03 | 4.73E-03 | 1.21E-03 | 2.07E-03 | 0.65 | 0.97 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_Adlercreutzia | 9.19E-04 | 1.95E-03 | 8.97E-04 | 1.92E-03 | 9.64E-04 | 2.04E-03 | 0.91 | 0.97 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_Atopobium | 1.73E-05 | 4.20E-05 | 1.51E-05 | 4.03E-05 | 2.19E-05 | 4.57E-05 | 0.29 | 0.93 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_Collinsella | 3.39E-03 | 6.50E-03 | 2.69E-03 | 4.97E-03 | 4.84E-03 | 8.81E-03 | 0.34 | 0.93 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_Eggerthella | 2.22E-04 | 5.77E-04 | 2.67E-04 | 6.87E-04 | 1.30E-04 | 1.96E-04 | 0.57 | 0.94 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_Slackia | 1.12E-04 | 4.01E-04 | 6.00E-05 | 2.78E-04 | 2.20E-04 | 5.70E-04 | 0.09 | 0.86 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_Bacteroidaceae.g\_\_Bacteroides | 3.94E-01 | 2.23E-01 | 3.90E-01 | 2.30E-01 | 4.04E-01 | 2.12E-01 | 0.80 | 0.97 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_Porphyromonadaceae.g\_\_Parabacteroides | 2.59E-02 | 1.96E-02 | 2.30E-02 | 1.56E-02 | 3.19E-02 | 2.53E-02 | 0.13 | 0.86 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_Porphyromonadaceae.g\_\_Porphyromonas | 2.21E-05 | 7.15E-05 | 2.99E-05 | 8.58E-05 | 5.93E-06 | 1.26E-05 | 0.54 | 0.93 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_Prevotellaceae.g\_\_Prevotella | 3.66E-02 | 1.03E-01 | 3.74E-02 | 1.03E-01 | 3.51E-02 | 1.05E-01 | 0.68 | 0.97 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_Rikenellaceae.Other | 3.36E-05 | 1.21E-04 | 3.66E-05 | 1.14E-04 | 2.74E-05 | 1.36E-04 | 0.04 | 0.79 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_Rikenellaceae.g\_\_ | 2.12E-02 | 2.87E-02 | 1.95E-02 | 2.57E-02 | 2.48E-02 | 3.42E-02 | 0.73 | 0.97 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_S24.7.g\_\_ | 1.93E-03 | 1.04E-02 | 1.79E-03 | 1.08E-02 | 2.24E-03 | 9.79E-03 | 0.39 | 0.93 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_.Barnesiellaceae..g\_\_ | 3.17E-03 | 7.10E-03 | 3.16E-03 | 6.78E-03 | 3.20E-03 | 7.85E-03 | 0.42 | 0.93 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_.Odoribacteraceae..g\_\_Butyricimonas | 3.29E-03 | 4.50E-03 | 3.17E-03 | 4.38E-03 | 3.53E-03 | 4.81E-03 | 0.66 | 0.97 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_.Odoribacteraceae..g\_\_Odoribacter | 4.67E-03 | 7.89E-03 | 4.70E-03 | 8.18E-03 | 4.63E-03 | 7.41E-03 | 0.90 | 0.97 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_.Paraprevotellaceae..g\_\_Paraprevotella | 3.35E-03 | 1.68E-02 | 2.47E-03 | 8.41E-03 | 5.18E-03 | 2.70E-02 | 0.27 | 0.93 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_.Paraprevotellaceae..g\_\_.Prevotella. | 1.22E-03 | 5.90E-03 | 4.98E-04 | 2.97E-03 | 2.72E-03 | 9.33E-03 | 0.47 | 0.93 |
| k\_\_Bacteria.p\_\_Cyanobacteria.c\_\_4C0d.2.o\_\_YS2.  f\_\_.g\_\_ | 2.65E-03 | 1.24E-02 | 1.62E-03 | 9.04E-03 | 4.78E-03 | 1.74E-02 | 0.32 | 0.93 |
| k\_\_Bacteria.p\_\_Cyanobacteria.c\_\_Chloroplast.o\_\_Streptophyta.  f\_\_.g\_\_ | 3.56E-05 | 2.37E-04 | 4.61E-05 | 2.88E-04 | 1.40E-05 | 3.13E-05 | 0.85 | 0.97 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Bacillales.  f\_\_Bacillaceae.g\_\_Anaerobacillus | 4.07E-05 | 1.86E-04 | 1.99E-05 | 4.63E-05 | 8.38E-05 | 3.18E-04 | 0.95 | 0.98 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Gemellales.  f\_\_Gemellaceae.g\_\_ | 2.91E-05 | 8.82E-05 | 3.40E-05 | 9.78E-05 | 1.88E-05 | 6.43E-05 | 0.47 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Lactobacillales.Other.Other | 9.59E-05 | 1.74E-04 | 1.00E-04 | 1.95E-04 | 8.74E-05 | 1.24E-04 | 0.44 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Lactobacillales.  f\_\_Lactobacillaceae.g\_\_Lactobacillus | 3.17E-03 | 1.78E-02 | 4.30E-03 | 2.16E-02 | 8.24E-04 | 1.92E-03 | 0.11 | 0.86 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Lactobacillales.  f\_\_Leuconostocaceae.g\_\_ | 1.93E-04 | 8.75E-04 | 2.50E-04 | 1.03E-03 | 7.55E-05 | 3.83E-04 | 0.42 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Lactobacillales.  f\_\_Streptococcaceae.g\_\_Lactococcus | 1.36E-04 | 5.05E-04 | 1.80E-04 | 6.10E-04 | 4.60E-05 | 7.51E-05 | 0.46 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Lactobacillales.  f\_\_Streptococcaceae.g\_\_Streptococcus | 6.89E-03 | 1.36E-02 | 8.21E-03 | 1.56E-02 | 4.15E-03 | 7.07E-03 | 0.51 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Turicibacterales.  f\_\_Turicibacteraceae.g\_\_Turicibacter | 3.80E-04 | 2.51E-03 | 5.48E-04 | 3.05E-03 | 3.10E-05 | 6.19E-05 | 0.48 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.Other.Other.Other | 1.23E-04 | 4.30E-04 | 1.20E-04 | 4.13E-04 | 1.29E-04 | 4.71E-04 | 0.46 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.Other.Other | 1.15E-03 | 1.61E-03 | 9.90E-04 | 1.05E-03 | 1.49E-03 | 2.37E-03 | 0.44 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.f\_\_.g\_\_ | 4.72E-02 | 3.83E-02 | 4.72E-02 | 3.87E-02 | 4.72E-02 | 3.80E-02 | 0.89 | 0.97 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Christensenellaceae.g\_\_ | 2.73E-03 | 6.75E-03 | 1.63E-03 | 2.98E-03 | 4.99E-03 | 1.08E-02 | 0.55 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Christensenellaceae.g\_\_Christensenella | 3.09E-05 | 6.35E-05 | 3.63E-05 | 7.23E-05 | 1.97E-05 | 3.84E-05 | 0.52 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Clostridiaceae.g\_\_ | 1.70E-03 | 4.41E-03 | 1.79E-03 | 5.08E-03 | 1.53E-03 | 2.56E-03 | 0.55 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Clostridiaceae.g\_\_Clostridium | 8.37E-04 | 2.00E-03 | 9.80E-04 | 2.32E-03 | 5.40E-04 | 1.04E-03 | 0.13 | 0.86 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Dehalobacteriaceae.g\_\_Dehalobacterium | 1.65E-04 | 3.50E-04 | 1.27E-04 | 2.36E-04 | 2.45E-04 | 5.06E-04 | 0.75 | 0.97 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_EtOH8.g\_\_ | 3.27E-05 | 1.32E-04 | 1.52E-05 | 4.32E-05 | 6.90E-05 | 2.21E-04 | 0.54 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Eubacteriaceae.g\_\_Anaerofustis | 3.11E-05 | 6.83E-05 | 3.16E-05 | 7.59E-05 | 2.99E-05 | 5.02E-05 | 0.63 | 0.97 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Eubacteriaceae.g\_\_Pseudoramibacter\_Eubacterium | 7.84E-05 | 3.79E-04 | 1.03E-04 | 4.57E-04 | 2.75E-05 | 7.68E-05 | 0.27 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.Other | 2.04E-03 | 2.28E-03 | 2.17E-03 | 2.37E-03 | 1.78E-03 | 2.10E-03 | 0.40 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_ | 5.07E-02 | 4.09E-02 | 4.89E-02 | 3.76E-02 | 5.46E-02 | 4.74E-02 | 0.94 | 0.98 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Anaerostipes | 9.01E-04 | 1.54E-03 | 7.19E-04 | 1.41E-03 | 1.28E-03 | 1.73E-03 | 0.06 | 0.86 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Blautia | 1.91E-02 | 2.10E-02 | 1.78E-02 | 1.85E-02 | 2.17E-02 | 2.56E-02 | 0.88 | 0.97 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Coprococcus | 9.91E-03 | 1.18E-02 | 1.03E-02 | 1.24E-02 | 9.18E-03 | 1.05E-02 | 0.81 | 0.97 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Dorea | 4.59E-03 | 6.77E-03 | 5.16E-03 | 7.38E-03 | 3.42E-03 | 5.21E-03 | 0.41 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Lachnobacterium | 1.91E-04 | 6.99E-04 | 2.05E-04 | 7.84E-04 | 1.62E-04 | 4.89E-04 | 0.34 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Lachnospira | 9.18E-03 | 1.07E-02 | 8.72E-03 | 1.06E-02 | 1.01E-02 | 1.12E-02 | 0.45 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Roseburia | 8.75E-04 | 9.97E-04 | 9.52E-04 | 1.06E-03 | 7.14E-04 | 8.58E-04 | 0.26 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_.Ruminococcus. | 8.78E-03 | 1.01E-02 | 8.66E-03 | 1.07E-02 | 9.03E-03 | 8.87E-03 | 0.89 | 0.97 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Peptococcaceae.g\_\_ | 9.44E-05 | 2.78E-04 | 7.47E-05 | 1.95E-04 | 1.35E-04 | 4.00E-04 | 0.61 | 0.97 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Peptococcaceae.g\_\_rc4.4 | 2.27E-04 | 7.94E-04 | 1.27E-04 | 3.63E-04 | 4.35E-04 | 1.28E-03 | 0.79 | 0.97 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Peptostreptococcaceae.g\_\_ | 3.16E-05 | 9.45E-05 | 4.25E-05 | 1.13E-04 | 9.22E-06 | 1.98E-05 | 0.36 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.Other | 2.76E-04 | 6.51E-04 | 2.80E-04 | 6.25E-04 | 2.68E-04 | 7.13E-04 | 1.00 | 1.00 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.g\_\_ | 4.71E-02 | 4.58E-02 | 4.32E-02 | 3.45E-02 | 5.50E-02 | 6.30E-02 | 0.78 | 0.97 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.g\_\_Anaerotruncus | 4.99E-04 | 1.61E-03 | 4.81E-04 | 1.63E-03 | 5.36E-04 | 1.58E-03 | 0.20 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.g\_\_Faecalibacterium | 3.89E-02 | 5.43E-02 | 3.50E-02 | 5.52E-02 | 4.70E-02 | 5.22E-02 | 0.26 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.g\_\_Oscillospira | 1.64E-02 | 1.20E-02 | 1.53E-02 | 1.20E-02 | 1.87E-02 | 1.18E-02 | 0.13 | 0.86 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.g\_\_Ruminococcus | 2.46E-02 | 2.87E-02 | 2.61E-02 | 3.15E-02 | 2.13E-02 | 2.18E-02 | 0.77 | 0.97 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.Other | 1.13E-03 | 1.07E-02 | 1.96E-05 | 6.17E-05 | 3.43E-03 | 1.88E-02 | 0.03 | 0.79 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_ | 4.30E-04 | 2.45E-03 | 5.31E-04 | 2.96E-03 | 2.23E-04 | 6.63E-04 | 0.90 | 0.97 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_Acidaminococcus | 1.12E-02 | 3.40E-02 | 1.46E-02 | 4.05E-02 | 4.10E-03 | 1.08E-02 | 0.99 | 1.00 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_Dialister | 9.54E-03 | 2.54E-02 | 9.58E-03 | 2.58E-02 | 9.46E-03 | 2.51E-02 | 0.18 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_Megasphaera | 9.13E-03 | 2.69E-02 | 8.26E-03 | 2.52E-02 | 1.09E-02 | 3.06E-02 | 0.70 | 0.97 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_Phascolarctobacterium | 4.18E-02 | 5.94E-02 | 4.39E-02 | 6.37E-02 | 3.75E-02 | 4.99E-02 | 0.36 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_Veillonella | 4.43E-03 | 1.68E-02 | 6.12E-03 | 2.03E-02 | 9.36E-04 | 2.00E-03 | 0.07 | 0.86 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_.Mogibacteriaceae..g\_\_ | 7.76E-04 | 1.31E-03 | 8.08E-04 | 1.48E-03 | 7.09E-04 | 8.71E-04 | 0.51 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Erysipelotrichi.o\_\_Erysipelotrichales.  f\_\_Erysipelotrichaceae.g\_\_ | 1.10E-03 | 2.63E-03 | 9.92E-04 | 2.69E-03 | 1.33E-03 | 2.52E-03 | 0.59 | 0.96 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Erysipelotrichi.o\_\_Erysipelotrichales.  f\_\_Erysipelotrichaceae.g\_\_Coprobacillus | 3.01E-04 | 9.37E-04 | 2.90E-04 | 1.02E-03 | 3.25E-04 | 7.45E-04 | 0.45 | 0.93 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Erysipelotrichi.o\_\_Erysipelotrichales.  f\_\_Erysipelotrichaceae.g\_\_Holdemania | 3.02E-04 | 5.09E-04 | 2.82E-04 | 4.77E-04 | 3.45E-04 | 5.77E-04 | 0.89 | 0.97 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Erysipelotrichi.o\_\_Erysipelotrichales.  f\_\_Erysipelotrichaceae.g\_\_.Eubacterium. | 1.19E-03 | 3.14E-03 | 1.36E-03 | 3.72E-03 | 8.28E-04 | 1.32E-03 | 0.72 | 0.97 |
| k\_\_Bacteria.p\_\_Fusobacteria.c\_\_Fusobacteriia.o\_\_Fusobacteriales.  f\_\_Fusobacteriaceae.g\_\_Fusobacterium | 4.66E-03 | 2.66E-02 | 2.75E-03 | 1.79E-02 | 8.60E-03 | 3.90E-02 | 0.82 | 0.97 |
| k\_\_Bacteria.p\_\_Lentisphaerae.c\_\_.Lentisphaeria..o\_\_Victivallales.  f\_\_Victivallaceae.g\_\_ | 1.01E-03 | 4.86E-03 | 1.18E-03 | 5.77E-03 | 6.74E-04 | 1.97E-03 | 0.71 | 0.97 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Alphaproteobacteria.o\_\_RF32.f\_\_.g\_\_ | 2.36E-03 | 9.41E-03 | 1.79E-03 | 5.32E-03 | 3.55E-03 | 1.47E-02 | 0.96 | 0.98 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Betaproteobacteria.o\_\_Burkholderiales.  f\_\_Alcaligenaceae.g\_\_Sutterella | 1.68E-02 | 1.81E-02 | 1.86E-02 | 2.04E-02 | 1.32E-02 | 1.14E-02 | 0.54 | 0.93 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Betaproteobacteria.o\_\_Burkholderiales.  f\_\_Comamonadaceae.Other | 2.09E-05 | 6.85E-05 | 1.51E-05 | 4.36E-05 | 3.27E-05 | 1.02E-04 | 0.75 | 0.97 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Betaproteobacteria.o\_\_Burkholderiales.  f\_\_Oxalobacteraceae.g\_\_Oxalobacter | 9.13E-05 | 1.76E-04 | 8.01E-05 | 1.47E-04 | 1.15E-04 | 2.26E-04 | 0.74 | 0.97 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Deltaproteobacteria.o\_\_Desulfovibrionales.  f\_\_Desulfovibrionaceae.g\_\_ | 3.66E-04 | 1.50E-03 | 5.03E-04 | 1.81E-03 | 8.32E-05 | 2.00E-04 | 0.42 | 0.93 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Deltaproteobacteria.o\_\_Desulfovibrionales.  f\_\_Desulfovibrionaceae.g\_\_Bilophila | 2.53E-03 | 3.44E-03 | 2.34E-03 | 3.43E-03 | 2.91E-03 | 3.49E-03 | 0.18 | 0.93 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Deltaproteobacteria.o\_\_Desulfovibrionales.  f\_\_Desulfovibrionaceae.g\_\_Desulfovibrio | 9.14E-04 | 2.37E-03 | 1.12E-03 | 2.73E-03 | 4.84E-04 | 1.29E-03 | 0.43 | 0.93 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Epsilonproteobacteria.o\_\_Campylobacterales.  f\_\_Campylobacteraceae.g\_\_Campylobacter | 5.30E-05 | 2.35E-04 | 7.50E-05 | 2.85E-04 | 7.44E-06 | 1.51E-05 | 0.38 | 0.93 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Enterobacteriales.  f\_\_Enterobacteriaceae.Other | 1.46E-04 | 3.38E-04 | 2.00E-04 | 3.98E-04 | 3.39E-05 | 6.72E-05 | 0.01 | 0.79 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Enterobacteriales.  f\_\_Enterobacteriaceae.g\_\_ | 4.17E-02 | 8.27E-02 | 5.59E-02 | 9.66E-02 | 1.22E-02 | 2.18E-02 | 0.12 | 0.86 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Enterobacteriales.  f\_\_Enterobacteriaceae.g\_\_Erwinia | 1.83E-05 | 6.84E-05 | 2.53E-05 | 8.24E-05 | 3.90E-06 | 9.41E-06 | 0.11 | 0.86 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Enterobacteriales.  f\_\_Enterobacteriaceae.g\_\_Serratia | 1.72E-05 | 3.98E-05 | 2.35E-05 | 4.68E-05 | 4.38E-06 | 1.04E-05 | 0.02 | 0.79 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Pasteurellales.  f\_\_Pasteurellaceae.g\_\_Haemophilus | 1.08E-03 | 3.95E-03 | 1.25E-03 | 4.55E-03 | 7.16E-04 | 2.24E-03 | 0.75 | 0.97 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Pseudomonadales.  f\_\_Pseudomonadaceae.g\_\_Pseudomonas | 9.20E-05 | 2.92E-04 | 6.30E-05 | 2.44E-04 | 1.52E-04 | 3.71E-04 | 0.27 | 0.93 |
| k\_\_Bacteria.p\_\_Synergistetes.c\_\_Synergistia.o\_\_Synergistales.  f\_\_Dethiosulfovibrionaceae.g\_\_Pyramidobacter | 1.22E-03 | 7.97E-03 | 1.80E-03 | 9.69E-03 | 4.95E-06 | 1.43E-05 | 0.03 | 0.79 |
| k\_\_Bacteria.p\_\_Synergistetes.c\_\_Synergistia.o\_\_Synergistales.  f\_\_Synergistaceae.Other | 6.56E-04 | 2.63E-03 | 6.87E-04 | 2.98E-03 | 5.93E-04 | 1.73E-03 | 0.63 | 0.97 |
| k\_\_Bacteria.p\_\_TM7.c\_\_TM7.3.o\_\_.f\_\_.g\_\_ | 2.17E-05 | 5.40E-05 | 2.22E-05 | 6.06E-05 | 2.05E-05 | 3.78E-05 | 0.11 | 0.86 |
| k\_\_Bacteria.p\_\_Tenericutes.c\_\_Mollicutes.o\_\_RF39.  f\_\_.g\_\_ | 2.57E-03 | 1.37E-02 | 2.00E-03 | 1.09E-02 | 3.76E-03 | 1.84E-02 | 0.44 | 0.93 |
| k\_\_Bacteria.p\_\_Verrucomicrobia.c\_\_Verrucomicrobiae.o\_\_Verrucomicrobiales.  f\_\_Verrucomicrobiaceae.g\_\_Akkermansia | 2.43E-02 | 6.27E-02 | 2.50E-02 | 6.42E-02 | 2.27E-02 | 6.03E-02 | 0.81 | 0.97 |

**Supplementary Table S6.** Relative abundance of genera in JoCo OA participants who did not have any hand pain (AUSCAN pain score = 0, N=46) versus those who had at least mild symptoms (AUSCAN pain score > 0, N=46). P: p-values from the non-parametric Wilcoxon test; Q: false discovery rate adjusted p-values; SD: standard deviation.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | ALL | | AUSCAN PAIN = 0  (N=46) | | AUSCAN PAIN > 0  (N=46) | |  |  |
| Taxon name | mean | sd | mean | sd | mean | sd | P | Q |
| k\_\_Archaea.p\_\_Euryarchaeota.c\_\_Methanobacteria.o\_\_Methanobacteriales.  f\_\_Methanobacteriaceae.g\_\_Methanobrevibacter | 1.27E-03 | 6.16E-03 | 1.54E-03 | 8.04E-03 | 9.87E-04 | 3.46E-03 | 0.28 | 0.84 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Actinobacteria.o\_\_Actinomycetales.  f\_\_Actinomycetaceae.g\_\_Actinomyces | 1.70E-04 | 3.80E-04 | 1.36E-04 | 2.57E-04 | 2.05E-04 | 4.72E-04 | 0.69 | 0.87 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Actinobacteria.o\_\_Actinomycetales.  f\_\_Micrococcaceae.g\_\_Rothia | 5.01E-05 | 1.27E-04 | 6.67E-05 | 1.60E-04 | 3.35E-05 | 8.02E-05 | 0.36 | 0.84 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Actinobacteria.o\_\_Bifidobacteriales.  f\_\_Bifidobacteriaceae.g\_\_Bifidobacterium | 3.54E-03 | 7.94E-03 | 3.02E-03 | 5.40E-03 | 4.06E-03 | 9.89E-03 | 0.55 | 0.87 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_ | 1.34E-03 | 4.04E-03 | 1.42E-03 | 5.32E-03 | 1.25E-03 | 2.18E-03 | 0.37 | 0.84 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_Adlercreutzia | 9.19E-04 | 1.95E-03 | 7.43E-04 | 1.16E-03 | 1.09E-03 | 2.51E-03 | 0.70 | 0.87 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_Atopobium | 1.73E-05 | 4.20E-05 | 1.37E-05 | 2.33E-05 | 2.09E-05 | 5.47E-05 | 0.43 | 0.84 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_Collinsella | 3.39E-03 | 6.50E-03 | 2.39E-03 | 5.03E-03 | 4.39E-03 | 7.63E-03 | 0.16 | 0.84 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_Eggerthella | 2.22E-04 | 5.77E-04 | 2.40E-04 | 5.52E-04 | 2.04E-04 | 6.06E-04 | 0.37 | 0.84 |
| k\_\_Bacteria.p\_\_Actinobacteria.c\_\_Coriobacteriia.o\_\_Coriobacteriales.  f\_\_Coriobacteriaceae.g\_\_Slackia | 1.12E-04 | 4.01E-04 | 9.90E-05 | 3.36E-04 | 1.25E-04 | 4.61E-04 | 0.47 | 0.87 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_Bacteroidaceae.g\_\_Bacteroides | 3.94E-01 | 2.23E-01 | 3.86E-01 | 2.20E-01 | 4.02E-01 | 2.29E-01 | 0.65 | 0.87 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_Porphyromonadaceae.g\_\_Parabacteroides | 2.59E-02 | 1.96E-02 | 2.46E-02 | 1.39E-02 | 2.72E-02 | 2.41E-02 | 0.89 | 0.93 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_Porphyromonadaceae.g\_\_Porphyromonas | 2.21E-05 | 7.15E-05 | 2.66E-05 | 7.27E-05 | 1.76E-05 | 7.09E-05 | 0.33 | 0.84 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_Prevotellaceae.g\_\_Prevotella | 3.66E-02 | 1.03E-01 | 4.48E-02 | 1.10E-01 | 2.85E-02 | 9.53E-02 | 0.70 | 0.87 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_Rikenellaceae.Other | 3.36E-05 | 1.21E-04 | 2.07E-05 | 5.90E-05 | 4.65E-05 | 1.60E-04 | 0.68 | 0.87 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_Rikenellaceae.g\_\_ | 2.12E-02 | 2.87E-02 | 1.84E-02 | 2.62E-02 | 2.39E-02 | 3.10E-02 | 0.78 | 0.88 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_S24.7.g\_\_ | 1.93E-03 | 1.04E-02 | 2.13E-03 | 1.24E-02 | 1.74E-03 | 8.04E-03 | 0.76 | 0.87 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_.Barnesiellaceae..g\_\_ | 3.17E-03 | 7.10E-03 | 2.77E-03 | 6.39E-03 | 3.57E-03 | 7.80E-03 | 0.72 | 0.87 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_.Odoribacteraceae..g\_\_Butyricimonas | 3.29E-03 | 4.50E-03 | 3.52E-03 | 4.43E-03 | 3.06E-03 | 4.61E-03 | 0.58 | 0.87 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_.Odoribacteraceae..g\_\_Odoribacter | 4.67E-03 | 7.89E-03 | 3.44E-03 | 4.94E-03 | 5.91E-03 | 9.93E-03 | 0.76 | 0.87 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_.Paraprevotellaceae..g\_\_Paraprevotella | 3.35E-03 | 1.68E-02 | 5.81E-03 | 2.33E-02 | 9.03E-04 | 3.40E-03 | 0.52 | 0.87 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.  f\_\_.Paraprevotellaceae..g\_\_.Prevotella. | 1.22E-03 | 5.90E-03 | 1.67E-03 | 7.29E-03 | 7.69E-04 | 4.09E-03 | 0.61 | 0.87 |
| k\_\_Bacteria.p\_\_Cyanobacteria.c\_\_4C0d.2.o\_\_YS2.[f\_\_.g\_\_ | 2.65E-03 | 1.24E-02 | 2.25E-03 | 1.06E-02 | 3.05E-03 | 1.41E-02 | 0.63 | 0.87 |
| k\_\_Bacteria.p\_\_Cyanobacteria.c\_\_Chloroplast.o\_\_Streptophyta.f\_\_.g\_\_ | 3.56E-05 | 2.37E-04 | 5.91E-05 | 3.35E-04 | 1.21E-05 | 2.75E-05 | 0.80 | 0.88 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Bacillales.  f\_\_Bacillaceae.g\_\_Anaerobacillus | 4.07E-05 | 1.86E-04 | 2.39E-05 | 7.51E-05 | 5.76E-05 | 2.52E-04 | 0.96 | 0.97 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Gemellales.  f\_\_Gemellaceae.g\_\_ | 2.91E-05 | 8.82E-05 | 4.69E-05 | 1.21E-04 | 1.13E-05 | 2.29E-05 | 0.33 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Lactobacillales.Other.Other | 9.59E-05 | 1.74E-04 | 1.10E-04 | 2.08E-04 | 8.15E-05 | 1.33E-04 | 0.71 | 0.87 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Lactobacillales.  f\_\_Lactobacillaceae.g\_\_Lactobacillus | 3.17E-03 | 1.78E-02 | 1.78E-03 | 5.02E-03 | 4.56E-03 | 2.47E-02 | 0.54 | 0.87 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Lactobacillales.  f\_\_Leuconostocaceae.g\_\_ | 1.93E-04 | 8.75E-04 | 1.72E-04 | 9.53E-04 | 2.14E-04 | 8.00E-04 | 0.67 | 0.87 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Lactobacillales.  f\_\_Streptococcaceae.g\_\_Lactococcus | 1.36E-04 | 5.05E-04 | 9.51E-05 | 2.36E-04 | 1.77E-04 | 6.76E-04 | 0.51 | 0.87 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Lactobacillales.  f\_\_Streptococcaceae.g\_\_Streptococcus | 6.89E-03 | 1.36E-02 | 7.89E-03 | 1.51E-02 | 5.89E-03 | 1.19E-02 | 0.44 | 0.85 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Bacilli.o\_\_Turicibacterales.  f\_\_Turicibacteraceae.g\_\_Turicibacter | 3.80E-04 | 2.51E-03 | 6.94E-04 | 3.54E-03 | 6.58E-05 | 1.13E-04 | 0.37 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.Other.Other.Other | 1.23E-04 | 4.30E-04 | 6.59E-05 | 1.45E-04 | 1.79E-04 | 5.89E-04 | 0.22 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.Other.Other | 1.15E-03 | 1.61E-03 | 9.00E-04 | 8.95E-04 | 1.40E-03 | 2.07E-03 | 0.33 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.f\_\_.g\_\_ | 4.72E-02 | 3.83E-02 | 4.30E-02 | 3.69E-02 | 5.14E-02 | 3.95E-02 | 0.40 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Christensenellaceae.g\_\_ | 2.73E-03 | 6.75E-03 | 9.65E-04 | 1.77E-03 | 4.49E-03 | 9.08E-03 | 0.04 | 0.62 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Christensenellaceae.g\_\_Christensenella | 3.09E-05 | 6.35E-05 | 3.24E-05 | 7.25E-05 | 2.95E-05 | 5.38E-05 | 0.85 | 0.92 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Clostridiaceae.g\_\_ | 1.70E-03 | 4.41E-03 | 1.97E-03 | 5.87E-03 | 1.44E-03 | 2.15E-03 | 0.51 | 0.87 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Clostridiaceae.g\_\_Clostridium | 8.37E-04 | 2.00E-03 | 7.65E-04 | 2.18E-03 | 9.08E-04 | 1.81E-03 | 0.66 | 0.87 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Dehalobacteriaceae.g\_\_Dehalobacterium | 1.65E-04 | 3.50E-04 | 7.83E-05 | 1.51E-04 | 2.52E-04 | 4.57E-04 | 0.36 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_EtOH8.g\_\_ | 3.27E-05 | 1.32E-04 | 1.12E-05 | 3.68E-05 | 5.42E-05 | 1.82E-04 | 0.39 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Eubacteriaceae.g\_\_Anaerofustis | 3.11E-05 | 6.83E-05 | 2.19E-05 | 5.49E-05 | 4.03E-05 | 7.89E-05 | 0.18 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Eubacteriaceae.g\_\_Pseudoramibacter\_Eubacterium | 7.84E-05 | 3.79E-04 | 1.32E-04 | 5.29E-04 | 2.45E-05 | 6.55E-05 | 0.38 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.Other | 2.04E-03 | 2.28E-03 | 2.22E-03 | 2.35E-03 | 1.86E-03 | 2.22E-03 | 0.26 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_ | 5.07E-02 | 4.09E-02 | 5.20E-02 | 4.17E-02 | 4.94E-02 | 4.06E-02 | 0.72 | 0.87 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Anaerostipes | 9.01E-04 | 1.54E-03 | 5.58E-04 | 8.92E-04 | 1.24E-03 | 1.93E-03 | 0.01 | 0.62 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Blautia | 1.91E-02 | 2.10E-02 | 1.68E-02 | 1.76E-02 | 2.13E-02 | 2.40E-02 | 0.34 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Coprococcus | 9.91E-03 | 1.18E-02 | 7.49E-03 | 8.75E-03 | 1.23E-02 | 1.39E-02 | 0.10 | 0.66 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Dorea | 4.59E-03 | 6.77E-03 | 4.43E-03 | 5.19E-03 | 4.75E-03 | 8.11E-03 | 0.36 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Lachnobacterium | 1.91E-04 | 6.99E-04 | 1.25E-04 | 3.35E-04 | 2.57E-04 | 9.31E-04 | 0.43 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Lachnospira | 9.18E-03 | 1.07E-02 | 8.41E-03 | 9.97E-03 | 9.95E-03 | 1.15E-02 | 0.40 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_Roseburia | 8.75E-04 | 9.97E-04 | 9.60E-04 | 1.07E-03 | 7.90E-04 | 9.24E-04 | 0.42 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Lachnospiraceae.g\_\_.Ruminococcus. | 8.78E-03 | 1.01E-02 | 7.94E-03 | 6.69E-03 | 9.62E-03 | 1.27E-02 | 0.93 | 0.95 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Peptococcaceae.g\_\_ | 9.44E-05 | 2.78E-04 | 7.95E-05 | 1.83E-04 | 1.09E-04 | 3.50E-04 | 0.63 | 0.87 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Peptococcaceae.g\_\_rc4.4 | 2.27E-04 | 7.94E-04 | 1.14E-04 | 3.60E-04 | 3.41E-04 | 1.06E-03 | 0.25 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Peptostreptococcaceae.g\_\_ | 3.16E-05 | 9.45E-05 | 4.32E-05 | 1.25E-04 | 2.00E-05 | 4.61E-05 | 0.63 | 0.87 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.Other | 2.76E-04 | 6.51E-04 | 1.50E-04 | 2.64E-04 | 4.02E-04 | 8.69E-04 | 0.21 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.g\_\_ | 4.71E-02 | 4.58E-02 | 3.74E-02 | 3.20E-02 | 5.68E-02 | 5.49E-02 | 0.07 | 0.62 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.g\_\_Anaerotruncus | 4.99E-04 | 1.61E-03 | 5.08E-04 | 1.88E-03 | 4.90E-04 | 1.29E-03 | 0.38 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.g\_\_Faecalibacterium | 3.89E-02 | 5.43E-02 | 4.43E-02 | 6.76E-02 | 3.36E-02 | 3.64E-02 | 0.86 | 0.92 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.g\_\_Oscillospira | 1.64E-02 | 1.20E-02 | 1.40E-02 | 1.13E-02 | 1.88E-02 | 1.23E-02 | 0.03 | 0.62 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Ruminococcaceae.g\_\_Ruminococcus | 2.46E-02 | 2.87E-02 | 1.97E-02 | 2.35E-02 | 2.94E-02 | 3.26E-02 | 0.04 | 0.62 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.Other | 1.13E-03 | 1.07E-02 | 1.11E-05 | 2.28E-05 | 2.25E-03 | 1.52E-02 | 0.63 | 0.87 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_ | 4.30E-04 | 2.45E-03 | 2.70E-04 | 1.70E-03 | 5.91E-04 | 3.04E-03 | 0.54 | 0.87 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_Acidaminococcus | 1.12E-02 | 3.40E-02 | 1.00E-02 | 3.12E-02 | 1.23E-02 | 3.70E-02 | 0.18 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_Dialister | 9.54E-03 | 2.54E-02 | 1.14E-02 | 2.93E-02 | 7.65E-03 | 2.11E-02 | 0.62 | 0.87 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_Megasphaera | 9.13E-03 | 2.69E-02 | 7.67E-03 | 2.36E-02 | 1.06E-02 | 3.01E-02 | 0.24 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_Phascolarctobacterium | 4.18E-02 | 5.94E-02 | 4.30E-02 | 6.88E-02 | 4.07E-02 | 4.89E-02 | 0.81 | 0.89 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_Veillonellaceae.g\_\_Veillonella | 4.43E-03 | 1.68E-02 | 4.17E-03 | 1.71E-02 | 4.68E-03 | 1.67E-02 | 0.08 | 0.62 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.  f\_\_.Mogibacteriaceae..g\_\_ | 7.76E-04 | 1.31E-03 | 8.20E-04 | 1.64E-03 | 7.32E-04 | 8.62E-04 | 0.39 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Erysipelotrichi.o\_\_Erysipelotrichales.  f\_\_Erysipelotrichaceae.g\_\_ | 1.10E-03 | 2.63E-03 | 1.01E-03 | 2.32E-03 | 1.20E-03 | 2.92E-03 | 0.64 | 0.87 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Erysipelotrichi.o\_\_Erysipelotrichales.  f\_\_Erysipelotrichaceae.g\_\_Coprobacillus | 3.01E-04 | 9.37E-04 | 3.03E-04 | 1.17E-03 | 3.00E-04 | 6.37E-04 | 0.08 | 0.62 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Erysipelotrichi.o\_\_Erysipelotrichales.  f\_\_Erysipelotrichaceae.g\_\_Holdemania | 3.02E-04 | 5.09E-04 | 2.17E-04 | 3.38E-04 | 3.88E-04 | 6.29E-04 | 0.18 | 0.84 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Erysipelotrichi.o\_\_Erysipelotrichales.  f\_\_Erysipelotrichaceae.g\_\_.Eubacterium. | 1.19E-03 | 3.14E-03 | 1.39E-03 | 3.97E-03 | 9.88E-04 | 2.03E-03 | 0.74 | 0.87 |
| k\_\_Bacteria.p\_\_Fusobacteria.c\_\_Fusobacteriia.o\_\_Fusobacteriales.  f\_\_Fusobacteriaceae.g\_\_Fusobacterium | 4.66E-03 | 2.66E-02 | 8.30E-03 | 3.73E-02 | 1.01E-03 | 3.63E-03 | 0.58 | 0.87 |
| k\_\_Bacteria.p\_\_Lentisphaerae.c\_\_.Lentisphaeria..o\_\_Victivallales.  f\_\_Victivallaceae.g\_\_ | 1.01E-03 | 4.86E-03 | 5.49E-04 | 1.64E-03 | 1.48E-03 | 6.68E-03 | 0.42 | 0.84 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Alphaproteobacteria.o\_\_RF32.f\_\_.g\_\_ | 2.36E-03 | 9.41E-03 | 2.24E-03 | 6.00E-03 | 2.49E-03 | 1.20E-02 | 0.31 | 0.84 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Betaproteobacteria.o\_\_Burkholderiales.  f\_\_Alcaligenaceae.g\_\_Sutterella | 1.68E-02 | 1.81E-02 | 1.97E-02 | 2.10E-02 | 1.40E-02 | 1.41E-02 | 0.34 | 0.84 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Betaproteobacteria.o\_\_Burkholderiales.  f\_\_Comamonadaceae.Other | 2.09E-05 | 6.85E-05 | 1.65E-05 | 4.92E-05 | 2.52E-05 | 8.38E-05 | 0.89 | 0.93 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Betaproteobacteria.o\_\_Burkholderiales.  f\_\_Oxalobacteraceae.g\_\_Oxalobacter | 9.13E-05 | 1.76E-04 | 8.55E-05 | 1.62E-04 | 9.72E-05 | 1.90E-04 | 0.91 | 0.94 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Deltaproteobacteria.o\_\_Desulfovibrionales.  f\_\_Desulfovibrionaceae.g\_\_ | 3.66E-04 | 1.50E-03 | 4.39E-04 | 1.79E-03 | 2.93E-04 | 1.15E-03 | 0.73 | 0.87 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Deltaproteobacteria.o\_\_Desulfovibrionales.  f\_\_Desulfovibrionaceae.g\_\_Bilophila | 2.53E-03 | 3.44E-03 | 2.81E-03 | 3.74E-03 | 2.25E-03 | 3.13E-03 | 0.62 | 0.87 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Deltaproteobacteria.o\_\_Desulfovibrionales.  f\_\_Desulfovibrionaceae.g\_\_Desulfovibrio | 9.14E-04 | 2.37E-03 | 1.06E-03 | 2.70E-03 | 7.72E-04 | 2.00E-03 | 0.77 | 0.87 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Epsilonproteobacteria.o\_\_Campylobacterales.  f\_\_Campylobacteraceae.g\_\_Campylobacter | 5.30E-05 | 2.35E-04 | 8.89E-05 | 3.27E-04 | 1.70E-05 | 5.16E-05 | 0.33 | 0.84 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Enterobacteriales.  f\_\_Enterobacteriaceae.Other | 1.46E-04 | 3.38E-04 | 1.84E-04 | 3.16E-04 | 1.07E-04 | 3.57E-04 | 0.02 | 0.62 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Enterobacteriales.  f\_\_Enterobacteriaceae.g\_\_ | 4.17E-02 | 8.27E-02 | 5.87E-02 | 9.87E-02 | 2.46E-02 | 5.91E-02 | 0.10 | 0.65 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Enterobacteriales  .f\_\_Enterobacteriaceae.g\_\_Erwinia | 1.83E-05 | 6.84E-05 | 1.80E-05 | 3.69E-05 | 1.86E-05 | 9.00E-05 | 0.05 | 0.62 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Enterobacteriales.  f\_\_Enterobacteriaceae.g\_\_Serratia | 1.72E-05 | 3.98E-05 | 2.76E-05 | 5.24E-05 | 6.85E-06 | 1.55E-05 | 0.01 | 0.62 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Pasteurellales.  f\_\_Pasteurellaceae.g\_\_Haemophilus | 1.08E-03 | 3.95E-03 | 1.14E-03 | 3.04E-03 | 1.02E-03 | 4.72E-03 | 0.42 | 0.84 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Gammaproteobacteria.o\_\_Pseudomonadales.  f\_\_Pseudomonadaceae.g\_\_Pseudomonas | 9.20E-05 | 2.92E-04 | 2.75E-05 | 1.18E-04 | 1.57E-04 | 3.88E-04 | 0.08 | 0.62 |
| k\_\_Bacteria.p\_\_Synergistetes.c\_\_Synergistia.o\_\_Synergistales.  f\_\_Dethiosulfovibrionaceae.g\_\_Pyramidobacter | 1.22E-03 | 7.97E-03 | 1.66E-03 | 1.01E-02 | 7.72E-04 | 5.11E-03 | 0.08 | 0.62 |
| k\_\_Bacteria.p\_\_Synergistetes.c\_\_Synergistia.o\_\_Synergistales.  f\_\_Synergistaceae.Other | 6.56E-04 | 2.63E-03 | 8.18E-04 | 3.43E-03 | 4.95E-04 | 1.47E-03 | 0.07 | 0.62 |
| k\_\_Bacteria.p\_\_TM7.c\_\_TM7.3.o\_\_.f\_\_.g\_\_ | 2.17E-05 | 5.40E-05 | 1.88E-05 | 4.81E-05 | 2.45E-05 | 5.98E-05 | 0.48 | 0.87 |
| k\_\_Bacteria.p\_\_Tenericutes.c\_\_Mollicutes.o\_\_RF39.f\_\_.g\_\_ | 2.57E-03 | 1.37E-02 | 9.47E-04 | 4.93E-03 | 4.20E-03 | 1.87E-02 | 0.99 | 0.99 |
| k\_\_Bacteria.p\_\_Verrucomicrobia.c\_\_Verrucomicrobiae.o\_\_Verrucomicrobiales.  f\_\_Verrucomicrobiaceae.g\_\_Akkermansia | 2.43E-02 | 6.27E-02 | 3.18E-02 | 8.40E-02 | 1.67E-02 | 2.78E-02 | 0.75 | 0.87 |

**Supplementary Table S8.** Individualclade analysis of mouse fecal taxon that differed in abundance between the obese OA and control groups at baseline (2 weeks after fecal transplant when diet was started).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | ALL | | obese OA | | obese non-OA | |  |  |  |
| Taxon name | mean | SD | mean | SD | mean | SD | ES | P | Q |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.f\_\_.Barnesiellaceae..g\_\_ | 8.38E-03 | 8.84E-03 | 1.57E-02 | 5.86E-03 | 6.00E-04 | 2.30E-03 | 0.80 | 2.99E-07 | 1.27E-05 |
| k\_\_Bacteria.p\_\_Cyanobacteria.c\_\_4C0d.2.o\_\_YS2.f\_\_.g\_\_ | 1.33E-02 | 1.58E-02 | 1.30E-03 | 3.06E-03 | 2.61E-02 | 1.37E-02 | 0.80 | 4.46E-07 | 1.27E-05 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.f\_\_.Odoribacteraceae..g\_\_Odoribacter | 1.77E-03 | 1.78E-03 | 3.11E-03 | 1.52E-03 | 3.43E-04 | 2.79E-04 | 0.78 | 9.25E-07 | 1.76E-05 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.f\_\_Rikenellaceae.g\_\_ | 6.58E-03 | 8.82E-03 | 2.60E-05 | 7.69E-05 | 1.36E-02 | 8.09E-03 | 0.77 | 1.81E-06 | 2.58E-05 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.f\_\_Lachnospiraceae.g\_\_Anaerostipes | 1.32E-03 | 2.60E-03 | 2.95E-06 | 1.31E-06 | 2.72E-03 | 3.22E-03 | 0.74 | 6.08E-06 | 6.93E-05 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.f\_\_Eubacteriaceae.g\_\_Pseudoramibacter\_Eubacterium | 8.36E-04 | 1.38E-03 | 1.03E-04 | 4.01E-04 | 1.62E-03 | 1.62E-03 | 0.72 | 1.37E-05 | 1.31E-04 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.f\_\_Ruminococcaceae.g\_\_Anaerotruncus | 9.26E-05 | 1.34E-04 | 1.77E-04 | 1.43E-04 | 2.86E-06 | 1.79E-06 | 0.70 | 2.92E-05 | 2.38E-04 |
| k\_\_Bacteria.p\_\_Bacteroidetes.c\_\_Bacteroidia.o\_\_Bacteroidales.f\_\_.Paraprevotellaceae..g\_\_Paraprevotella | 5.16E-03 | 7.31E-03 | 9.44E-04 | 3.77E-03 | 9.66E-03 | 7.57E-03 | 0.69 | 3.71E-05 | 2.64E-04 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Erysipelotrichi.o\_\_Erysipelotrichales.f\_\_Erysipelotrichaceae.g\_\_Holdemania | 9.28E-04 | 4.07E-04 | 6.82E-04 | 2.88E-04 | 1.19E-03 | 3.51E-04 | 0.67 | 7.34E-05 | 4.65E-04 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.f\_\_.g\_\_ | 3.49E-03 | 2.33E-03 | 2.15E-03 | 1.91E-03 | 4.93E-03 | 1.86E-03 | 0.61 | 3.70E-04 | 1.91E-03 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.f\_\_Ruminococcaceae.g\_\_Oscillospira | 1.35E-02 | 6.50E-03 | 1.71E-02 | 7.06E-03 | 9.59E-03 | 2.40E-03 | 0.61 | 3.70E-04 | 1.91E-03 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.f\_\_Ruminococcaceae.g\_\_Ruminococcus | 1.34E-02 | 2.20E-02 | 3.65E-03 | 3.13E-03 | 2.39E-02 | 2.83E-02 | 0.58 | 7.56E-04 | 3.31E-03 |
| k\_\_Bacteria.p\_\_Verrucomicrobia.c\_\_Verrucomicrobiae.o\_\_Verrucomicrobiales.f\_\_Verrucomicrobiaceae.g\_\_Akkermansia | 1.24E-01 | 4.68E-02 | 1.52E-01 | 4.16E-02 | 9.46E-02 | 3.23E-02 | 0.58 | 7.56E-04 | 3.31E-03 |
| k\_\_Bacteria.p\_\_Firmicutes.c\_\_Clostridia.o\_\_Clostridiales.f\_\_EtOH8.g\_\_ | 4.01E-05 | 7.30E-05 | 2.95E-06 | 1.31E-06 | 7.97E-05 | 9.03E-05 | 5.61E-01 | 1.25E-03 | 5.08E-03 |
| k\_\_Bacteria.p\_\_Proteobacteria.c\_\_Betaproteobacteria.o\_\_Burkholderiales.f\_\_Alcaligenaceae.g\_\_Sutterella | 3.69E-03 | 6.71E-03 | 9.82E-04 | 3.92E-03 | 6.57E-03 | 7.92E-03 | 5.04E-01 | 4.19E-03 | 1.49E-02 |