

Table S1. Wet weight, metabolites level, and microbiota composition of the cecum in mice fed mixed casein, A1 casein, A2 casein, soy protein isolate, and egg white for four weeks.

| | Mixed casein | A1 casein | A2 casein | Soy | Egg white | SE |
|---|--------------------|--------------------|--------------------|--------------------|-------------------|------|
| Cecum weight (g/100g body weight) | | | | | | |
| Tissue | 0.27 | 0.29 | 0.29 | 0.24 | 0.36 | 0.04 |
| Content | 1.34 ^a | 1.18 ^{ab} | 1.00 ^{ab} | 0.73 ^b | 1.53 ^a | 0.13 |
| Short-chain fatty acids ($\mu\text{mol/g}$) | | | | | | |
| Acetic acid | 35.6 ^{ab} | 53.2 ^a | 31.1 ^b | 27.5 ^b | 27.9 ^b | 5.21 |
| Propionic acid | 4.18 ^a | 6.37 ^a | 5.37 ^a | 4.89 ^a | 1.72 ^b | 0.79 |
| <i>iso</i> -Butyric acid | 0.49 ^{ab} | 0.65 ^a | 0.51 ^a | 0.21 ^{bc} | 0.10 ^c | 0.10 |
| <i>n</i> -Butyric acid | 2.28 | 2.59 | 2.30 | 1.76 | 1.35 | 0.32 |
| Total SCFAs | 42.6 ^{ab} | 62.8 ^a | 39.3 ^{ab} | 34.3 ^b | 31.1 ^b | 6.05 |
| Ammonia-N ($\mu\text{g/g}$) | 215 ^b | 210 ^b | 198 ^b | 292 ^a | 217 ^b | 16.2 |
| Total population (\log_{10} copies/g) | 8.63 | 8.80 | 8.86 | 9.15 | 9.10 | 0.21 |
| Alpha diversity | | | | | | |
| Chao 1 | 168 ^a | 162 ^a | 164 ^a | 170 ^a | 90.6 ^b | 15.9 |
| Shannon index | 2.10 ^{ab} | 2.28 ^{ab} | 2.18 ^{ab} | 2.67 ^a | 1.83 ^b | 0.18 |
| Phylum (%) | | | | | | |
| Actinomycetota | 17.5 | 15.9 | 23.9 | 13.0 | 19.1 | 4.87 |
| Bacteroidota | 0.22 ^{cd} | 0.34 ^{bc} | 0.12 ^d | 5.75 ^{ab} | 7.59 ^a | 2.12 |
| Desulfobacterota | 1.98 ^b | 7.47 ^a | 0.06 ^c | 7.79 ^a | 1.20 ^b | 1.75 |
| Bacillota | 79.9 | 75.6 | 72.5 | 66.1 | 60.5 | 5.63 |
| Pseudomonadota | 0.28 | 0.22 | 2.94 | 0.71 | 0.20 | 0.90 |
| Verrucomicrobiota | 0.17 ^b | 0.36 ^b | 0.53 ^b | 6.61 ^a | 11.3 ^a | 2.87 |

Mean values for five mice. Values in the same row with unlike superscript letters are significantly different based on the non-parametric Kruskal-Wallis sum-rank test ($p<0.05$).

Table S2. Microbiota of the cecum in mice fed mixed casein, A1 casein, A2 casein, soy protein isolate, and egg white for four weeks

| | Mixed casein | A1 casein | A2 casein | Soy | Egg white | SE |
|--|--------------------|--------------------|--------------------|--------------------|--------------------|------|
| Family (%) | | | | | | |
| Bifidobacteriaceae | 17.0 | 15.5 | 22.7 | 11.2 | 17.5 | 5.03 |
| Corynebacteriaceae | 0.24 ^a | 0.06 ^{ab} | 0.36 ^{ab} | 1.43 ^a | 0.01 ^b | 0.40 |
| Eggerthellaceae | 0.24 ^b | 0.30 ^b | 0.82 ^a | 0.28 ^b | 1.61 ^a | 0.29 |
| Bacteroidaceae | 0.04 ^{bc} | 0.03 ^c | 0.04 ^{bc} | 1.20 ^{ab} | 2.25 ^a | 0.57 |
| Muribaculaceae | 0.13 ^{bc} | 0.26 ^b | 0.05 ^c | 3.94 ^a | 2.80 ^{ab} | 1.32 |
| Rikenellaceae | 0.04 ^b | 0.04 ^b | 0.02 ^b | 0.23 ^{ab} | 2.52 ^a | 0.85 |
| Desulfovibrionaceae | 1.98 ^b | 7.47 ^a | 0.06 ^c | 7.79 ^a | 1.20 ^b | 1.75 |
| Erysipelatoclostridiaceae | 0.57 ^b | 0.95 ^{ab} | 2.11 ^{ab} | 3.29 ^{ab} | 3.40 ^a | 1.15 |
| Erysipelotrichaceae | 46.9 ^a | 37.4 ^{ab} | 45.6 ^a | 16.9 ^b | 52.0 ^a | 6.48 |
| Aerococcaceae | 1.77 | 2.83 | 3.44 | 1.58 | 0.34 | 1.33 |
| Enterococcaceae | 0.06 | 0.02 | 0.18 | 0.05 | 0.12 | 0.09 |
| Lactobacillaceae | 9.73 ^a | 6.65 ^{ab} | 3.15 ^b | 6.24 ^{ab} | 0.23 ^c | 1.72 |
| Staphylococcaceae | 8.39 ^{ab} | 14.5 ^a | 5.68 ^{ab} | 18.0 ^a | 1.27 ^b | 4.11 |
| Clostridiaceae | 4.06 ^a | 1.34 ^b | 1.85 ^{ab} | 0.91 ^b | 0.38 ^b | 0.60 |
| Lachnospiraceae | 0.65 | 0.55 | 1.51 | 2.56 | 2.19 | 0.75 |
| Monoglobaceae | 0.09 | 0.13 | 0.13 | 0.41 | 0.00 | 0.10 |
| Oscillospiraceae | 0.42 | 0.19 | 0.23 | 1.09 | 0.01 | 0.27 |
| Ruminococcaceae | 0.08 ^a | 0.06 ^a | 0.10 ^a | 1.83 ^a | 0.01 ^b | 0.30 |
| Eubacterium coprostanoligenes group | 0.38 ^a | 0.03 ^{ab} | 0.02 ^{ab} | 0.06 ^{ab} | 0.00 ^b | 0.09 |
| Moraxellaceae | 0.25 | 0.15 | 2.87 | 0.58 | 0.09 | 0.88 |
| Akkermansiaceae | 0.17 ^b | 0.36 ^b | 0.53 ^b | 6.61 ^a | 11.3 ^a | 2.87 |

Mean values for five mice. Values in the same row with unlike superscript letters are significantly different based on the non-parametric Kruskal-Wallis sum-rank test ($p<0.05$).

Table S3. Results of PERMANOVA using a Bray-Curtis distance matrix to examine differences in the cecum microbiota of mice fed mixed casein, A1 casein, A2 casein, soy, and egg white.

Transform: Square root

Resemblance: S17 Bray-Curtis similarity

Sums of squares type: Partial

Permutation method: Unrestricted permutation of raw data

Number of permutations: 999

PERMANOVA table of results

| Source | df | SS | MS | Pseudo-F | P(perm) |
|----------|----|--------|--------|----------|---------|
| Protein | 4 | 7885.6 | 1971.4 | 4.8737 | 0.001 |
| Residual | 20 | 8090 | 404.5 | | |
| Total | 24 | 15976 | | | |

Pair-wise tests

| Groups | t | P(perm) | perms |
|-------------|--------|---------|-------|
| Casein, A1 | 1.2315 | 0.244 | 126 |
| Casein, A2 | 1.3211 | 0.151 | 126 |
| Casein, Soy | 2.0395 | 0.029 | 126 |
| Casein, Egg | 3.0751 | 0.007 | 126 |
| A1, A2 | 1.5956 | 0.033 | 126 |
| A1, Soy | 1.639 | 0.048 | 126 |
| A1, Egg | 3.1508 | 0.008 | 126 |
| A2, Soy | 2.0252 | 0.024 | 126 |
| A2, Egg | 2.3345 | 0.018 | 126 |
| Soy, Egg | 2.4769 | 0.012 | 126 |
