# Supplementary Data

**Table S1** Comparison of rumen microbiota abundance and diversity on a phyla level and taken from young bulls finished in a feedlot with and without natural additive addition to the diet

|  |  |  |  |
| --- | --- | --- | --- |
|  | Experimental diets |  | P - value |
| Item | CON1 | NA152 | NA303 | NA454 | NA605 | SEM6 | L7 | Q8 | 0% *VS* NA |
| *Acidobacteria* | 0.38 | 0.18 | 0.00 | 0.18 | 0.69 | 0.090 | 0.9956 | 0.4442 | 0.2394 |
| *Actinobacteria* | 111.06 | 113.71 | 119.29 | 137.37 | 110.30 | 8.811 | 0.4348 | 0.8104 | 0.6147 |
| *Armatimonadetes* | 0.62 | 3.15 | 0.59 | 1.52 | 2.03 | 0.366 | 0.1466 | 0.0749 | 0.2128 |
| *Ascomycota* | 2.98 | 5.58 | 3.49 | 6.20 | 3.38 | 0.916 | 0.8407 | 0.3714 | 0.4054 |
| *Bacteria Unassigned* | 433.76 | 575.71 | 456.95 | 533.21 | 453.11 | 27.140 | 0.6257 | 0.2041 | 0.2224 |
| *Bacteroidetes* | 16160.51 | 11326.14 | 14614.40 | 10228.94 | 14757.65 | 558.359 | 0.3308 | 0.0007 | 0.0002 |
| *Candidatus\_Melainabacteria* | 0.57 | 1.40 | 0.16 | 0.64 | 1.79 | 0.294 | 0.4207 | 0.2982 | 0.8348 |
| *Candidatus\_Saccharibacteria* | 96.63 | 126.12 | 650.91 | 94.89 | 82.16 | 68.575 | 0.8633 | 0.0023 | 0.1993 |
| *Chlamydiae* | 0.34 | 6.19 | 2.35 | 1.47 | 2.50 | 1.063 | 0.1804 | 0.6209 | 0.2935 |
| *Chytridiomycota* | 0.00 | 0.00 | 1.71 | 0.50 | 0.15 | 0.168 | 0.1796 | 0.0002 | 0.0214 |
| *Elusimicrobia* | 16.18 | 29.03 | 6.30 | 36.54 | 10.10 | 3.459 | 0.4058 | 0.0025 | 0.2943 |
| *Eukaryota Unassigned* | 292.52 | 385.65 | 1465.95 | 657.81 | 321.10 | 133.601 | 0.4362 | 0.0047 | 0.0660 |
| *Euryarchaeota* | 373.89 | 484.60 | 424.23 | 559.15 | 368.18 | 38.519 | 0.5523 | 0.3715 | 0.2652 |
| *Fibrobacteres* | 20.71 | 57.45 | 31.85 | 43.45 | 34.86 | 3.680 | 0.1495 | 0.0323 | 0.0058 |
| *Firmicutes* | 8638.23 | 11173.60 | 8667.37 | 12985.44 | 8435.01 | 501.631 | 0.1391 | 0.0032 | 0.0263 |
| *Fusobacteria* | 0.53 | 1.69 | 2.40 | 1.69 | 0.87 | 0.441 | 0.997 | 0.5776 | 0.2519 |
|  |  |  |  |  |  |  | *To be continued* |
| ***Table S1 continuation*** |  |  |  |  |  |  |  |  |  |
|  | Experimental diets |  | P - value |
| Item | CON1 | NA152 | NA303 | NA454 | NA605 | SEM6 | L7 | Q8 | 0% *VS* NA |
| *Ignavibacteriae* | 0.00 | 0.52 | 0.75 | 0.53 | 0.40 | 0.118 | 0.9688 | 0.4988 | 0.0604 |
| *Kiritimatiellaeota* | 159.89 | 143.67 | 147.88 | 134.34 | 116.10 | 17.630 | 0.8783 | 0.8664 | 0.7191 |
| *Lentisphaerae* | 18.77 | 98.15 | 49.19 | 46.69 | 35.70 | 12.932 | 0.2206 | 0.5172 | 0.1823 |
| *Proteobacteria* | 718.33 | 1869.80 | 694.15 | 882.44 | 2246.77 | 208.117 | 0.0913 | 0.1725 | 0.3549 |
| *Spirochaetes* | 284.19 | 900.12 | 182.81 | 147.33 | 283.95 | 114.013 | 0.0404 | 0.2653 | 0.6583 |
| *Streptophyta* | 1.58 | 1.18 | 1.28 | 4.28 | 0.29 | 0.511 | 0.0509 | 0.2747 | 0.5917 |
| *Synergistetes* | 19.25 | 15.21 | 15.49 | 23.87 | 16.59 | 1.257 | 0.0301 | 0.222 | 0.7313 |
| *Tenericutes* | 564.86 | 461.80 | 360.21 | 1305.04 | 549.34 | 99.138 | 0.0028 | 0.0242 | 0.4842 |
| *Verrucomicrobia* | 8.29 | 10.03 | 4.36 | 9.09 | 11.20 | 1.234 | 0.8131 | 0.1436 | 0.8859 |

¹CON = control (without natural additives); 2NA15 – addition of 1.5 g/animal/day of natural additives; 3NA30 – addition of 3.0 g/animal/ day of natural additives; 4NA45 – addition of 4.5 g/animal/day of natural additives; 5NA60 – addition of 6.0 g/animal/day of natural additives. Naturals additives contained clove leaf essential oil (Ferquima®), castor and cashew functional oils (Safeeds®) and a commercial blend composed of vanillin, eugenol and thymol (Safeeds®); 6Standard error of means; 7Linear effect; 8Quadratic effect.

**Table S2** Comparison of rumen microbiota abundance and diversity on a family level and taken from young bulls finished in a feedlot with and without natural additive addition to the diet

|  |  |  |  |
| --- | --- | --- | --- |
|  | Experimental diets |  | P - value |
| Item | CON1 | NA152 | NA303 | NA454 | NA605 | SEM6 | L7 | Q8 | 0% *VS* NA |
| *Acetobacteraceae* | 54.331 | 100.215 | 55.982 | 118.683 | 85.867 | 16.422 | 0.7362 | 0.2670 | 0.4082 |
| *Acidaminococcaceae* | 1.115 | 1.449 | 0.683 | 2.749 | 0.924 | 0.206 | 0.0163 | 0.0036 | 0.2208 |
| *Anaerolineaceae* | 0.123 | 0.681 | 0.469 | 0.441 | 0.457 | 0.099 | 0.4580 | 0.7404 | 0.1317 |
| *Atopobiaceae* | 15.260 | 13.590 | 9.853 | 16.583 | 12.948 | 1.421 | 0.5271 | 0.2084 | 0.6188 |
| *Bacillaceae* | 0.460 | 0.772 | 0.290 | 5.661 | 0.855 | 0.650 | 0.0105 | 0.0650 | 0.2222 |
| *Bacteroidaceae* | 3.861 | 4.013 | 2.841 | 3.547 | 3.905 | 0.394 | 0.7300 | 0.4245 | 0.7208 |
| *Barnesiellaceae* | 1.822 | 0.565 | 2.007 | 0.000 | 4.124 | 0.652 | 0.7825 | 0.3365 | 0.5654 |
| *Bifidobacteriaceae* | 6.396 | 3.336 | 4.619 | 4.230 | 3.485 | 0.721 | 0.7107 | 0.6887 | 0.2429 |
| *Cardiobacteriaceae* | 0.616 | 0.512 | 2.875 | 0.000 | 0.620 | 0.334 | 0.5816 | 0.0035 | 0.4996 |
| *Caulobacteraceae* | 0.000 | 0.000 | 0.000 | 0.000 | 4.744 | 0.775 | 1.0000 | 1.0000 | 1.0000 |
| *Chlamydiaceae* | 0.123 | 2.178 | 0.724 | 0.407 | 1.357 | 0.403 | 0.1868 | 0.6177 | 0.3653 |
| *Christensenellaceae* | 733.769 | 1344.960 | 820.652 | 1501.560 | 1190.320 | 89.216 | 0.4982 | 0.0061 | 0.0158 |
| *Clostridiaceae* | 1.257 | 1.118 | 2.276 | 1.980 | 1.139 | 0.258 | 0.3087 | 0.3213 | 0.4372 |
| *Clostridiales\_Family\_XIII.\_Incertae\_Sedis* | 0.535 | 1.660 | 0.179 | 1.850 | 0.327 | 0.187 | 0.6551 | 0.0003 | 0.0552 |
| *Comamonadaceae* | 0.123 | 0.279 | 0.869 | 0.328 | 0.293 | 0.153 | 0.9221 | 0.2057 | 0.376 |
| *Coriobacteriaceae* | 1.098 | 1.592 | 0.931 | 0.402 | 0.834 | 0.157 | 0.0197 | 0.8724 | 0.752 |
| *Corynebacteriaceae* | 1.338 | 2.942 | 2.461 | 5.660 | 5.019 | 1.090 | 0.4588 | 0.5616 | 0.4333 |
| *Cryomorphaceae* | 1.323 | 0.882 | 0.497 | 0.000 | 0.615 | 0.185 | 0.1335 | 0.9101 | 0.0752 |
| *Defluviitaleaceae* | 18.501 | 8.874 | 5.495 | 33.789 | 7.671 | 2.610 | 0.0001 | 0.0022 | 0.5707 |
| *Dermatophilaceae* | 0.000 | 0.844 | 0.359 | 0.164 | 0.654 | 0.151 | 0.1688 | 0.7276 | 0.2552 |
|  |  |  |  |  |  |  | *To be continued* |
| ***Table S2 continuation*** |  |  |  |  |  |  |  |  |  |
|  | Experimental diets |  | P - value |
| Item | CON1 | NA152 | NA303 | NA454 | NA605 | SEM6 | L7 | Q8 | 0% *VS* NA |
| *Desulfobulbaceae* | 0.123 | 0.281 | 0.683 | 0.402 | 0.648 | 0.090 | 0.6642 | 0.1651 | 0.1526 |
| *Desulfovibrionaceae* | 2.339 | 4.519 | 0.145 | 2.043 | 1.685 | 0.548 | 0.1416 | 0.0367 | 0.9382 |
| *Eggerthellaceae* | 12.227 | 29.950 | 20.147 | 22.128 | 14.544 | 3.400 | 0.4822 | 0.5404 | 0.199 |
| *Endomicrobiaceae* | 2.150 | 11.168 | 0.179 | 3.672 | 2.439 | 1.736 | 0.1792 | 0.1362 | 0.5233 |
| *Erysipelotrichaceae* | 116.685 | 591.156 | 111.579 | 229.610 | 98.629 | 70.791 | 0.0954 | 0.1105 | 0.2634 |
| *Intrasporangiaceae* | 0.000 | 0.000 | 0.000 | 0.000 | 2.127 | 0.347 | 1.0000 | 1.0000 | 1.0000 |
| *Isotrichidae* | 0.343 | 1.854 | 3.455 | 3.800 | 0.327 | 0.609 | 0.3013 | 0.6969 | 0.0872 |
| *Lachnospiraceae* | 1427.700 | 1728.430 | 1526.870 | 2081.600 | 1454.130 | 90.932 | 0.1960 | 0.1138 | 0.1189 |
| *Lactobacillaceae* | 0.508 | 0.878 | 0.862 | 2.766 | 1.092 | 0.248 | 0.0087 | 0.1031 | 0.0755 |
| *Marinilabiliaceae* | 0.123 | 1.336 | 0.000 | 0.730 | 2.698 | 0.325 | 0.5015 | 0.1929 | 0.4432 |
| *Methanobacteriaceae* | 69.378 | 102.964 | 107.117 | 139.585 | 71.720 | 8.165 | 0.1051 | 0.4574 | 0.0144 |
| *Micrococcaceae* | 0.123 | 0.163 | 0.145 | 0.657 | 0.591 | 0.126 | 0.2339 | 0.4558 | 0.5530 |
| *Muribaculaceae* | 1479.060 | 876.607 | 1476.590 | 881.527 | 1668.200 | 171.398 | 0.9929 | 0.2204 | 0.3788 |
| *Mycoplasmataceae* | 0.589 | 1.060 | 0.434 | 0.000 | 0.377 | 0.163 | 0.0504 | 0.8304 | 0.8283 |
| *Neisseriaceae* | 4.637 | 8.160 | 3.303 | 1.307 | 3.782 | 1.020 | 0.0422 | 0.6066 | 0.8843 |
| *Oligosphaeraceae* | 1.497 | 2.514 | 3.117 | 2.161 | 0.586 | 0.306 | 0.6871 | 0.3108 | 0.1353 |
| *Ophryoscolecidae* | 33.795 | 60.325 | 198.408 | 82.155 | 44.667 | 18.433 | 0.6542 | 0.0062 | 0.0552 |
| *Oscillospiraceae* | 0.000 | 0.423 | 0.786 | 0.000 | 0.491 | 0.113 | 0.2125 | 0.0567 | 0.1486 |
| *Paenibacillaceae* | 0.123 | 0.200 | 0.000 | 2.403 | 0.000 | 0.273 | 0.0039 | 0.0380 | 0.1927 |
| *Paludibacteraceae* | 0.370 | 0.419 | 0.434 | 0.402 | 0.343 | 0.106 | 0.9633 | 0.9401 | 0.8727 |
| *Pasteurellaceae* | 0.172 | 0.379 | 0.248 | 0.475 | 0.750 | 0.098 | 0.7602 | 0.5110 | 0.4459 |
| *Peptococcaceae* | 2.150 | 2.756 | 0.179 | 1.058 | 0.879 | 0.329 | 0.0837 | 0.0450 | 0.2953 |
|  |  |  |  |  |  |  | *To be continued* |
| ***Table S2 continuation*** |  |  |  |  |  |  |  |  |  |
|  | Experimental diets |  | P - value |
| Item | CON1 | NA152 | NA303 | NA454 | NA605 | SEM6 | L7 | Q8 | 0% *VS* NA |
| *Peptostreptococcaceae* | 1.942 | 0.824 | 1.441 | 1.517 | 2.367 | 0.316 | 0.5089 | 0.7648 | 0.4274 |
| *Planococcaceae* | 0.123 | 6.688 | 2.999 | 2.098 | 4.246 | 1.024 | 0.1658 | 0.6195 | 0.1597 |
| *Porphyromonadaceae* | 0.833 | 0.000 | 0.000 | 1.696 | 0.214 | 0.177 | 0.0004 | 0.0248 | 0.4266 |
| *Prevotellaceae* | 9655.940 | 6053.800 | 9052.390 | 5831.610 | 8313.770 | 498.941 | 0.8689 | 0.0137 | 0.0228 |
| *Puniceicoccaceae* | 0.172 | 0.479 | 0.786 | 1.228 | 2.960 | 0.353 | 0.4653 | 0.9391 | 0.4316 |
| *Rhodobacteraceae* | 0.165 | 0.000 | 0.000 | 0.803 | 1.636 | 0.269 | 0.3374 | 0.5767 | 0.8796 |
| *Rikenellaceae* | 886.272 | 1971.880 | 1099.030 | 1211.420 | 940.601 | 127.199 | 0.0380 | 0.1122 | 0.0671 |
| *Ruminococcaceae* | 2904.550 | 4332.780 | 3040.840 | 5290.690 | 2870.990 | 283.216 | 0.1881 | 0.0087 | 0.0327 |
| *Selenomonadaceae* | 11.204 | 10.309 | 10.308 | 12.683 | 8.390 | 0.988 | 0.4774 | 0.6802 | 0.9695 |
| *Sphingobacteriaceae* | 0.616 | 0.518 | 0.393 | 0.204 | 0.620 | 0.137 | 0.5023 | 0.9367 | 0.5231 |
| *Spirochaetaceae* | 224.925 | 176.088 | 141.433 | 123.213 | 146.101 | 20.803 | 0.4428 | 0.8896 | 0.1724 |
| *Streptococcaceae* | 1.269 | 7.247 | 2.220 | 5.067 | 5.520 | 1.016 | 0.4978 | 0.1653 | 0.1806 |
| *Succinivibrionaceae* | 155.679 | 258.673 | 85.399 | 100.275 | 743.708 | 72.568 | 0.3946 | 0.5574 | 0.9599 |
| *Synergistaceae* | 1.789 | 2.388 | 1.538 | 3.082 | 2.060 | 0.344 | 0.5451 | 0.2374 | 0.5574 |
| *Trichomonadidae* | 0.165 | 1.129 | 0.538 | 0.000 | 0.130 | 0.147 | 0.0141 | 0.9417 | 0.2682 |
| *Veillonellaceae* | 103.460 | 187.525 | 135.379 | 201.587 | 202.634 | 15.800 | 0.7676 | 0.1610 | 0.0774 |
| *Victivallaceae* | 0.743 | 19.671 | 2.565 | 2.319 | 3.189 | 3.235 | 0.0994 | 0.3439 | 0.3748 |

¹CON = control (without natural additives); 2NA15 – addition of 1.5 g/animal/day of natural additives; 3NA30 – addition of 3.0 g/animal/ day of natural additives; 4NA45 – addition of 4.5 g/animal/day of natural additives; 5NA60 – addition of 6.0 g/animal/day of natural additives. Naturals additives contained clove leaf essential oil (Ferquima®). castor and cashew functional oils (Safeeds®) and a commercial blend composed of vanillin. eugenol and thymol (Safeeds®); 6Standard error of means; 7Linear effect; 8Quadratic effect.

**Table S3** Comparison of rumen microbiota abundance and diversity on a genus level and taken from young bulls finished in a feedlot with and without natural additive addition to the diet

|  |  |  |  |
| --- | --- | --- | --- |
|  | Experimental diets |  | P - value |
| Item | CON1 | NA152 | NA303 | NA454 | NA605 | SEM6 | L7 | Q8 | 0% *VS* NA |
| *Acetanaerobacterium* | 0.50 | 0.31 | 0.55 | 0.18 | 0.35 | 0.07 | 0.5935 | 0.1471 | 0.4425 |
| *Acetitomaculum* | 423.40 | 133.21 | 293.38 | 188.53 | 158.05 | 28.64 | 0.3987 | 0.0271 | 0.0005 |
| *Acetobacter* | 135.95 | 121.93 | 91.33 | 167.65 | 158.81 | 23.42 | 0.5684 | 0.4428 | 0.8905 |
| *Acidaminococcus* | 2.14 | 0.11 | 0.00 | 0.00 | 1.38 | 0.34 | 0.9116 | 0.9489 | 0.0203 |
| *Agathobacter* | 6.34 | 6.08 | 7.93 | 8.04 | 6.91 | 0.74 | 0.4403 | 0.5691 | 0.6244 |
| *Akkermansia* | 9.57 | 3.74 | 1.83 | 0.90 | 3.89 | 1.05 | 0.3481 | 0.8516 | 0.0061 |
| *Alistipes* | 2.74 | 1.80 | 1.70 | 4.18 | 0.96 | 0.35 | 0.0187 | 0.1259 | 0.8206 |
| *Alloprevotella* | 110.06 | 18.54 | 2.81 | 16.24 | 7.78 | 12.17 | 0.9424 | 0.5971 | 0.0011 |
| *Anaerobiospirillum* | 0.74 | 1.58 | 0.77 | 0.55 | 7.75 | 1.19 | 0.7801 | 0.9528 | 0.9402 |
| *Anaerofustis* | 0.46 | 1.02 | 1.49 | 1.10 | 1.43 | 0.30 | 0.9393 | 0.6305 | 0.3809 |
| *Anaeroplasma* | 7.59 | 12.73 | 14.54 | 14.82 | 21.52 | 2.49 | 0.7972 | 0.9135 | 0.3371 |
| *Anaerosporobacter* | 4.57 | 5.65 | 4.09 | 12.51 | 10.40 | 1.81 | 0.2498 | 0.3311 | 0.5528 |
| *Anaerostipes* | 3.72 | 3.53 | 0.43 | 6.62 | 6.94 | 0.62 | 0.0293 | 0.0006 | 0.8544 |
| *Anaerotruncus* | 0.26 | 0.40 | 0.68 | 0.62 | 0.33 | 0.11 | 0.5332 | 0.5724 | 0.2980 |
| *Anaerovibrio* | 29.98 | 30.62 | 45.57 | 48.65 | 55.44 | 6.14 | 0.3787 | 0.7357 | 0.4850 |
| *Anaerovorax* | 36.67 | 34.45 | 39.86 | 56.49 | 57.69 | 4.51 | 0.1292 | 0.6469 | 0.5493 |
| *Asteroleplasma* | 1.73 | 0.28 | 1.53 | 1.70 | 0.17 | 0.21 | 0.0168 | 0.2624 | 0.2264 |
| *Atopobium* | 2.93 | 3.34 | 2.52 | 9.38 | 4.79 | 0.69 | 0.0012 | 0.0119 | 0.1161 |
| *Bacillus* | 0.50 | 2.12 | 0.21 | 8.18 | 1.89 | 0.92 | 0.0216 | 0.0295 | 0.1459 |
| *Bacteroides* | 58.74 | 48.27 | 22.72 | 43.80 | 27.55 | 5.14 | 0.7701 | 0.0899 | 0.1125 |
|  |  |  |  |  |  | *To be continued* |
| ***Table S3 continuation*** |  |  |  |  |  |  |  |
|  | Experimental diets |  | P - value |
| Item | CON1 | NA152 | NA303 | NA454 | NA605 | SEM6 | L7 | Q8 | 0% *VS* NA |
| *Bavariicoccus* | 0.00 | 0.00 | 0.00 | 1.74 | 0.25 | 0.21 | 0.0054 | 0.0868 | 0.2174 |
| *Bifidobacterium* | 36.94 | 15.14 | 42.88 | 35.31 | 8.55 | 5.30 | 0.2142 | 0.2093 | 0.6547 |
| *Bilophila* | 0.72 | 1.67 | 0.43 | 0.00 | 1.22 | 0.26 | 0.0503 | 0.5624 | 0.9749 |
| *Blautia* | 59.92 | 60.49 | 70.51 | 104.59 | 37.81 | 7.98 | 0.0690 | 0.5518 | 0.3325 |
| *Brevibacterium* | 0.00 | 0.00 | 0.00 | 0.00 | 1.92 | 0.22 | 0.9990 | 0.9990 | 1.0000 |
| *Brevundimonas* | 0.00 | 0.00 | 0.00 | 0.00 | 4.92 | 0.80 | 1.0000 | 1.0000 | 1.0000 |
| *Butyricicoccus* | 2.32 | 2.69 | 1.66 | 2.58 | 3.28 | 0.37 | 0.9330 | 0.3725 | 0.9937 |
| *Butyrivibrio* | 17.45 | 22.25 | 25.49 | 28.65 | 18.80 | 2.33 | 0.4061 | 0.9946 | 0.2074 |
| *Campylobacter* | 2.00 | 6.81 | 1.75 | 4.77 | 7.54 | 0.83 | 0.3878 | 0.0573 | 0.2101 |
| *Candidatus\_Saccharimonas* | 130.78 | 123.83 | 651.40 | 101.98 | 98.45 | 66.68 | 0.9011 | 0.0019 | 0.2677 |
| *Candidatus\_Soleaferrea* | 13.22 | 21.64 | 6.01 | 18.42 | 40.35 | 5.49 | 0.8532 | 0.3576 | 0.8807 |
| *Candidatus\_Symbiothrix* | 4.57 | 0.45 | 0.64 | 0.55 | 0.17 | 0.43 | 0.9122 | 0.8626 | <.0001 |
| *Caproiciproducens* | 1.54 | 2.05 | 0.98 | 0.95 | 2.75 | 0.39 | 0.3899 | 0.6365 | 0.8394 |
| *Catenibacterium* | 1.48 | 1.11 | 0.43 | 0.90 | 0.89 | 0.17 | 0.7062 | 0.2450 | 0.1547 |
| *Catenisphaera* | 2.63 | 0.00 | 0.21 | 1.66 | 0.00 | 0.42 | 0.2017 | 0.5774 | 0.0650 |
| *Cellulosilyticum* | 0.00 | 0.98 | 0.00 | 0.00 | 0.25 | 0.20 | 0.3660 | 0.3812 | 0.5338 |
| *Citreitalea* | 1.04 | 1.24 | 0.00 | 0.00 | 0.00 | 0.20 | 0.0429 | 0.2263 | 0.1934 |
| *Clostridium* | 6.48 | 0.20 | 0.00 | 0.18 | 1.06 | 1.05 | 0.9968 | 0.9459 | 0.0240 |
| *Collinsella* | 0.68 | 0.77 | 0.90 | 1.11 | 0.36 | 0.13 | 0.4301 | 0.9007 | 0.4946 |
| *Comamonas* | 1.18 | 0.29 | 0.85 | 1.32 | 6.50 | 0.72 | 0.5999 | 0.9777 | 0.8230 |
| *Corynebacterium* | 0.74 | 1.34 | 2.26 | 2.93 | 3.14 | 0.60 | 0.4294 | 0.9423 | 0.3841 |
| *Dasytricha* | 0.23 | 9.82 | 16.93 | 12.17 | 0.36 | 2.70 | 0.7740 | 0.4067 | 0.0678 |
|  |  |  |  |  |  |  | *To be continued* |
| ***Table S3 continuation*** |  |  |  |  |  |  |  |  |  |
|  | Experimental diets |  | P - value |
| Item | CON1 | NA152 | NA303 | NA454 | NA605 | SEM6 | L7 | Q8 | 0% *VS* NA |
| *Desulfobulbus* | 2.12 | 1.23 | 1.53 | 2.54 | 4.76 | 0.43 | 0.2818 | 0.7368 | 0.7158 |
| *Desulfotomaculum* | 0.23 | 0.74 | 0.34 | 0.00 | 0.70 | 0.14 | 0.1051 | 0.9388 | 0.7138 |
| *Desulfovibrio* | 37.11 | 22.26 | 15.43 | 17.82 | 19.22 | 3.57 | 0.6934 | 0.6365 | 0.0534 |
| *Dialister* | 4.02 | 0.44 | 0.00 | 0.93 | 6.98 | 1.04 | 0.8731 | 0.7987 | 0.1687 |
| *Dorea* | 4.71 | 2.60 | 9.12 | 5.38 | 2.65 | 0.61 | 0.0393 | 0.0001 | 0.3469 |
| *Eisenbergiella* | 2.52 | 1.34 | 0.43 | 2.41 | 2.04 | 0.30 | 0.2314 | 0.0681 | 0.1284 |
| *Elusimicrobium* | 17.35 | 16.20 | 7.55 | 35.45 | 7.68 | 2.99 | 0.0178 | 0.0103 | 0.6997 |
| *Enterorhabdus* | 3.30 | 3.85 | 4.22 | 5.80 | 3.92 | 0.54 | 0.2893 | 0.7017 | 0.3783 |
| *Entodinium* | 108.29 | 57.41 | 367.78 | 144.36 | 89.00 | 31.65 | 0.2703 | 0.0007 | 0.2075 |
| *Faecalibacterium* | 20.93 | 11.42 | 35.08 | 20.64 | 15.49 | 2.73 | 0.2371 | 0.0087 | 0.8163 |
| *Fibrobacter* | 28.40 | 54.55 | 37.00 | 46.44 | 38.10 | 3.41 | 0.4272 | 0.1350 | 0.0436 |
| *Flavonifractor* | 2.48 | 3.12 | 1.19 | 1.80 | 2.07 | 0.38 | 0.3023 | 0.2528 | 0.6671 |
| *Flexilinea* | 2.20 | 10.45 | 7.25 | 9.59 | 8.37 | 1.43 | 0.8496 | 0.4867 | 0.0765 |
| *Fretibacterium* | 19.35 | 9.70 | 14.45 | 15.65 | 12.99 | 1.00 | 0.0350 | 0.4450 | 0.0103 |
| *Fusicatenibacter* | 0.52 | 0.44 | 0.34 | 0.22 | 1.07 | 0.13 | 0.5852 | 0.9677 | 0.5652 |
| *Fusobacterium* | 0.46 | 0.62 | 1.70 | 1.10 | 0.88 | 0.31 | 0.6495 | 0.3600 | 0.4314 |
| *Haemophilus* | 0.23 | 0.14 | 1.71 | 0.00 | 0.52 | 0.21 | 0.8203 | 0.0051 | 0.4400 |
| *Holdemanella* | 0.26 | 0.00 | 1.11 | 1.27 | 1.11 | 0.17 | 0.0115 | 0.2413 | 0.1678 |
| *Howardella* | 15.04 | 13.97 | 12.23 | 20.11 | 16.55 | 1.16 | 0.1005 | 0.1350 | 0.8928 |
| *Hydrogenispora* | 0.26 | 0.46 | 0.64 | 0.40 | 1.19 | 0.15 | 0.9095 | 0.6127 | 0.5439 |
| *Hydrogenoanaerobacterium* | 2.44 | 4.46 | 5.54 | 5.58 | 1.83 | 0.48 | 0.3716 | 0.6286 | 0.0125 |
| *Intestinimonas* | 3.60 | 2.28 | 3.84 | 2.24 | 1.89 | 0.34 | 0.9716 | 0.0897 | 0.3426 |
|  |  |  |  |  |  |  | *To be continued* |
| ***Table S3 continuation*** |  |  |  |  |  |  |  |  |  |
|  | Experimental diets |  | P - value |
| Item | CON1 | NA152 | NA303 | NA454 | NA605 | SEM6 | L7 | Q8 | 0% *VS* NA |
| *Kocuria* | 0.24 | 0.48 | 0.43 | 1.28 | 1.33 | 0.29 | 0.4122 | 0.5879 | 0.5370 |
| *Lachnobacterium* | 3.66 | 1.83 | 2.60 | 1.48 | 1.23 | 0.43 | 0.7992 | 0.4284 | 0.1411 |
| *Lachnoclostridium* | 31.21 | 23.52 | 15.26 | 38.72 | 26.80 | 3.44 | 0.1659 | 0.0987 | 0.5404 |
| *Lachnospira* | 1.77 | 0.85 | 3.28 | 2.40 | 1.35 | 0.36 | 0.1663 | 0.0926 | 0.6486 |
| *Lactobacillus* | 90.81 | 62.80 | 71.27 | 121.98 | 113.57 | 11.38 | 0.1151 | 0.5049 | 0.8542 |
| *Mailhella* | 1.78 | 1.85 | 0.21 | 0.40 | 0.25 | 0.23 | 0.0258 | 0.0950 | 0.0643 |
| *Marvinbryantia* | 336.21 | 360.84 | 453.81 | 624.69 | 191.88 | 50.59 | 0.0803 | 0.7567 | 0.2337 |
| *Megasphaera* | 2.52 | 3.55 | 0.55 | 1.54 | 1.37 | 0.58 | 0.2975 | 0.2346 | 0.6812 |
| *Mogibacterium* | 91.03 | 98.45 | 102.94 | 99.18 | 91.64 | 7.72 | 0.9784 | 0.8592 | 0.6768 |
| *Moraxella* | 0.68 | 0.75 | 0.00 | 0.00 | 0.53 | 0.14 | 0.0995 | 0.3306 | 0.2341 |
| *Moryella* | 68.52 | 40.67 | 53.79 | 95.57 | 31.65 | 6.41 | 0.0020 | 0.2984 | 0.6866 |
| *Mycoplasma* | 2.12 | 3.24 | 0.85 | 0.83 | 1.44 | 0.43 | 0.0919 | 0.3280 | 0.6681 |
| *Negativibacillus* | 4.53 | 6.88 | 11.47 | 6.21 | 1.73 | 1.39 | 0.8771 | 0.1953 | 0.3037 |
| *Olsenella* | 14.98 | 8.42 | 9.76 | 8.72 | 10.67 | 1.40 | 0.9473 | 0.7645 | 0.1198 |
| *Oribacterium* | 17.16 | 18.24 | 12.62 | 15.84 | 17.39 | 1.47 | 0.6287 | 0.3079 | 0.6935 |
| *Oscillibacter* | 4.41 | 5.87 | 4.01 | 4.21 | 4.09 | 0.55 | 0.3772 | 0.5227 | 0.8512 |
| *Oscillospira* | 0.00 | 1.67 | 0.68 | 1.31 | 1.88 | 0.33 | 0.7315 | 0.3794 | 0.1645 |
| *Paenibacillus* | 0.72 | 1.28 | 1.41 | 3.53 | 1.22 | 0.36 | 0.0410 | 0.2769 | 0.1239 |
| *Papillibacter* | 15.39 | 26.61 | 18.67 | 30.07 | 27.07 | 3.63 | 0.7753 | 0.3615 | 0.3309 |
| *Parabacteroides* | 15.90 | 0.92 | 1.53 | 1.86 | 25.04 | 3.72 | 0.3917 | 0.9878 | 0.1189 |
| *Paraprevotella* | 36.44 | 9.80 | 24.60 | 50.42 | 21.44 | 4.82 | 0.0071 | 0.6432 | 0.4686 |
| *Phascolarctobacterium* | 2.10 | 1.27 | 0.64 | 1.17 | 0.48 | 0.21 | 0.8666 | 0.2682 | 0.0380 |
|  |  |  |  |  |  |  | *To be continued* |
| ***Table S3 continuation*** |  |  |  |  |  |  |  |  |  |
|  | Experimental diets |  | P - value |
| Item | CON1 | NA152 | NA303 | NA454 | NA605 | SEM6 | L7 | Q8 | 0% *VS* NA |
| *Pichia* | 0.48 | 0.57 | 0.21 | 0.58 | 0.50 | 0.12 | 0.9736 | 0.3250 | 0.9441 |
| *Pirellula* | 1.00 | 9.40 | 5.37 | 2.75 | 1.46 | 1.68 | 0.2314 | 0.8817 | 0.2846 |
| *Polyplastron* | 1.53 | 2.32 | 2.22 | 0.22 | 0.35 | 0.46 | 0.1681 | 0.4639 | 0.9628 |
| *Porphyromonas* | 0.00 | 0.34 | 1.07 | 0.22 | 0.90 | 0.20 | 0.8496 | 0.1716 | 0.3127 |
| *Prevotella* | 420.17 | 176.86 | 249.22 | 146.86 | 276.41 | 26.51 | 0.6351 | 0.1209 | 0.0002 |
| *Pseudobutyrivibrio* | 4.38 | 6.00 | 3.41 | 5.93 | 6.54 | 0.64 | 0.9760 | 0.1703 | 0.6709 |
| *Pseudoflavonifractor* | 0.72 | 1.16 | 0.43 | 0.93 | 0.35 | 0.14 | 0.6099 | 0.1208 | 0.7371 |
| *Pseudoscardovia* | 0.00 | 0.00 | 3.41 | 0.00 | 0.00 | 0.41 | 1.0000 | 0.0014 | 0.2065 |
| *Pyramidobacter* | 4.24 | 2.46 | 2.52 | 6.70 | 3.17 | 0.56 | 0.0150 | 0.1499 | 0.7905 |
| *Raoultibacter* | 0.46 | 0.43 | 0.64 | 0.40 | 1.14 | 0.11 | 0.9355 | 0.4617 | 0.9057 |
| *Robinsoniella* | 5.25 | 0.00 | 1.92 | 0.28 | 0.00 | 0.64 | 0.8717 | 0.2383 | 0.0038 |
| *Romboutsia* | 0.00 | 1.38 | 1.32 | 6.12 | 7.29 | 1.08 | 0.1435 | 0.3784 | 0.2608 |
| *Roseburia* | 29.29 | 32.81 | 30.61 | 57.97 | 18.61 | 3.78 | 0.0136 | 0.0812 | 0.1566 |
| *Ruminiclostridium* | 11.31 | 18.61 | 7.84 | 10.77 | 10.53 | 1.55 | 0.1133 | 0.1108 | 0.7786 |
| *Ruminobacter* | 10.43 | 270.77 | 72.99 | 3.66 | 24.20 | 40.59 | 0.0398 | 0.5484 | 0.3007 |
| *Ruminococcus* | 5.36 | 3.83 | 5.20 | 2.47 | 4.17 | 0.68 | 0.5493 | 0.3046 | 0.4154 |
| *Saccharofermentans* | 124.26 | 62.24 | 70.38 | 106.81 | 87.99 | 10.72 | 0.1974 | 0.6304 | 0.1191 |
| *Schwartzia* | 32.34 | 15.73 | 29.71 | 15.58 | 19.08 | 2.72 | 0.9848 | 0.0553 | 0.0801 |
| *Sediminispirochaeta* | 1.18 | 5.32 | 1.83 | 3.01 | 4.58 | 0.58 | 0.1875 | 0.1270 | 0.1262 |
| *Selenomonas* | 16.04 | 18.47 | 20.16 | 18.75 | 14.17 | 1.71 | 0.9618 | 0.7570 | 0.5153 |
| *Sharpea* | 3.80 | 0.00 | 2.13 | 0.83 | 1.51 | 0.57 | 0.6425 | 0.2736 | 0.0640 |
| *Shuttleworthia* | 9.60 | 3.90 | 5.50 | 6.71 | 6.77 | 0.82 | 0.2732 | 0.9291 | 0.0511 |
|  |  |  |  |  |  |  | *To be continued* |
| ***Table S3 continuation*** |  |  |  |  |  |  |  |  |  |
|  | Experimental diets |  | P - value |
| Item | CON1 | NA152 | NA303 | NA454 | NA605 | SEM6 | L7 | Q8 | 0% *VS* NA |
| *Solobacterium* | 5.86 | 7.75 | 8.48 | 7.96 | 2.94 | 0.80 | 0.9279 | 0.7646 | 0.2704 |
| *Sphaerochaeta* | 30.41 | 555.78 | 23.49 | 14.66 | 149.18 | 78.72 | 0.0292 | 0.2043 | 0.3835 |
| *Sphingobacterium* | 0.00 | 0.11 | 0.85 | 0.22 | 0.70 | 0.15 | 0.8292 | 0.1092 | 0.3182 |
| *Sporobacter* | 1.94 | 2.53 | 2.05 | 7.55 | 2.81 | 0.50 | <.0001 | 0.0008 | 0.0085 |
| *Streptococcus* | 29.40 | 63.03 | 38.15 | 64.75 | 58.43 | 7.80 | 0.9459 | 0.2493 | 0.2198 |
| *Subdoligranulum* | 11.93 | 8.46 | 8.57 | 20.83 | 7.24 | 1.22 | <.0001 | 0.0078 | 0.7266 |
| *Succiniclasticum* | 563.59 | 460.78 | 393.19 | 510.09 | 508.53 | 49.67 | 0.7712 | 0.5314 | 0.4345 |
| *Succinimonas* | 3.64 | 0.74 | 0.00 | 0.00 | 1.17 | 0.46 | 0.5625 | 0.7374 | 0.0037 |
| *Succinivibrio* | 338.21 | 536.55 | 209.73 | 410.38 | 1039.20 | 95.89 | 0.6370 | 0.2610 | 0.8279 |
| *Suttonella* | 0.96 | 0.10 | 1.19 | 0.00 | 0.36 | 0.21 | 0.8778 | 0.0486 | 0.3151 |
| *Syntrophococcus* | 15.00 | 8.76 | 6.91 | 18.53 | 11.94 | 1.53 | 0.0371 | 0.0906 | 0.3254 |
| *Tetratrichomonas* | 1.28 | 4.50 | 1.32 | 0.00 | 0.72 | 0.50 | 0.0031 | 0.4330 | 0.5524 |
| *Treponema* | 9.06 | 6.32 | 9.81 | 2.73 | 8.71 | 1.25 | 0.3743 | 0.1380 | 0.3998 |
| *Turicibacter* | 1.64 | 5.51 | 3.50 | 5.64 | 14.52 | 1.66 | 0.9785 | 0.6224 | 0.4185 |
| *Weissella* | 1.76 | 0.31 | 0.43 | 0.87 | 0.88 | 0.19 | 0.3073 | 0.7206 | 0.0107 |

¹CON = control (without natural additives); 2NA15 – addition of 1.5 g/animal/day of natural additives; 3NA30 – addition of 3.0 g/animal/ day of natural additives; 4NA45 – addition of 4.5 g/animal/day of natural additives; 5NA60 – addition of 6.0 g/animal/day of natural additives. Naturals additives contained clove leaf essential oil (Ferquima®). castor and cashew functional oils (Safeeds®) and a commercial blend composed of vanillin, eugenol and thymol (Safeeds®); 6Standard error of means; 7Linear effect; 8Quadratic effect.

**Table S4 Functional gene annotation using InterPro results with significance level (P < 0.05) from DESeq (-Log10P)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Experimental diets |  | *P* – value |
| Item | CON1 | NA152 | NA303 | NA454 | NA605 | *SEM*6 | L7 | Q8 | 0% *vs* blend |
| IPR000412 | 271.20 | 84.40 | 114.00 | 103.00 | 167.00 | 2.13 | 0.2859 | 0.0941 | <.0001 |
| IPR003688 | 1479.00 | 1770.40 | 1158.20 | 2219.20 | 4790.80 | 73.03 | 0.0037 | 0.007 | 0.7416 |
| IPR005498 | 185.80 | 327.40 | 133.20 | 182.20 | 1872.80 | 39.41 | 0.0169 | 0.004 | 0.9442 |
| IPR006783 | 520.00 | 80.80 | 46.20 | 126.00 | 47.60 | 8.58 | 0.0013 | <.0001 | <.0001 |
| IPR007430 | 127.20 | 182.00 | 60.00 | 84.20 | 1649.60 | 35.65 | 0.0159 | 0.0027 | 0.9593 |
| IPR007534 | 530.00 | 139.40 | 138.20 | 238.80 | 214.80 | 7.03 | <.0001 | 0.0003 | <.0001 |
| IPR008274 | 2521.20 | 5073.20 | 2469.80 | 4450.20 | 3035.20 | 62.79 | 0.8597 | 0.4546 | 0.0328 |
| IPR008338 | 19.80 | 110.40 | 14.80 | 71.00 | 26.80 | 2.72 | 0.3272 | 0.0370 | 0.1699 |
| IPR008729 | 470.00 | 16.00 | 25.00 | 27.80 | 412.60 | 15.11 | 0.8518 | 0.0221 | 0.0205 |
| IPR008840 | 244.80 | 295.40 | 506.80 | 889.20 | 317.00 | 12.07 | 0.0001 | 0.4401 | 0.0054 |
| IPR009951 | 354.00 | 50.40 | 28.80 | 79.20 | 191.60 | 6.37 | 0.1948 | 0.0001 | <.0001 |
| IPR010258 | 173.80 | 192.20 | 90.00 | 120.80 | 2040.00 | 44.99 | 0.0178 | 0.0034 | 0.9327 |
| IPR010575 | 29.80 | 25.00 | 9.20 | 15.00 | 487.60 | 11.14 | 0.0180 | 0.0034 | 0.9081 |
| IPR015177 | 269.20 | 20.40 | 122.80 | 40.20 | 16.80 | 4.38 | 0.0006 | 0.0005 | <.0001 |
| IPR015314 | 367.20 | 39.40 | 137.80 | 145.20 | 296.60 | 7.89 | 0.9022 | 0.0237 | 0.0080 |
| IPR016905 | 134.00 | 274.80 | 181.20 | 708.80 | 203.00 | 10.92 | 0.1419 | 0.1105 | 0.0157 |
| IPR018219 | 151.00 | 4.40 | 6.80 | 13.20 | 166.80 | 4.20 | 0.7923 | 0.0005 | 0.0025 |
| IPR019072 | 378.80 | 13.40 | 31.00 | 25.20 | 30.60 | 7.88 | 0.0107 | 0.0014 | 0.0001 |
| IPR021865 | 3.00 | 46.40 | 9.00 | 355.80 | 31.20 | 8.19 | 0.0082 | 0.0481 | 0.1348 |
| IPR023180 | 100.20 | 138.60 | 86.00 | 122.80 | 266.00 | 3.09 | 0.0019 | <.0001 | 0.5090 |
| IPR024363 | 995.00 | 332.40 | 446.00 | 446.80 | 645.00 | 11.09 | 0.1385 | <.0001 | <.0001 |
| IPR024590 | 156.20 | 285.40 | 130.80 | 189.00 | 514.00 | 7.80 | 0.0213 | 0.0084 | 0.5525 |
| IPR025127 | 90.80 | 491.20 | 153.80 | 927.00 | 354.00 | 21.75 | 0.2178 | 0.3121 | 0.1047 |
|  |  |  |  |  |  |  | *To be continued* |
| ***Table S4 continuation*** |
|  | Experimental diets |  | *P* – value |
| Item | CON1 | NA152 | NA303 | NA454 | NA605 | *SEM*6 | L7 | Q8 | 0% *vs* blend |
| IPR025338 | 5.20 | 1.20 | 3.80 | 3.20 | 2.00 | 0.14 | 0.3734 | 0.6242 | 0.1754 |
| IPR025529 | 11.20 | 134.60 | 188.00 | 13.80 | 47.00 | 3.37 | 0.0207 | 0.1985 | 0.2703 |
| IPR025636 | 2394.20 | 1246.40 | 1584.20 | 1128.20 | 1775.60 | 21.88 | 0.0792 | 0.0003 | <.0001 |
| IPR028993 | 54.20 | 10.40 | 8.00 | 13.20 | 6.80 | 1.01 | 0.0066 | 0.0017 | 0.0002 |
| IPR032585 | 7.00 | 20.20 | 4.00 | 8.80 | 11.60 | 0.40 | 0.0573 | 0.0444 | 0.3963 |

¹CON = control (without natural additives); 2NA15 – addition of 1.5 g/animal/day of natural additives; 3NA30 – addition of 3.0 g/animal/ day of natural additives; 4NA45 – addition of 4.5 g/animal/day of natural additives; 5NA60 – addition of 6.0 g/animal/day of natural additives. Naturals additives contained clove leaf essential oil (Ferquima®), castor and cashew functional oils (Safeeds®) and a commercial blend composed of vanillin, eugenol and thymol (Safeeds®); 6Standard error of means; 7Linear effect; 8Quadratic effect. IPR019072 = Restriction endonuclease, type II, XamI; IPR018219 = Thiol peroxidase conserved site; IPR015177 = Lyase, catalytic; IPR007534 = Acyl-protein synthetase, LuxE; IPR024363 = Protein of unknown function DUF3853; IPR008729 = Phenolic acid decarboxylase, bacterial; IPR015314 = Restriction endonuclease, type II, EcoRV; IPR009951 = Host-nuclease inhibitor protein Gam; IPR000412 = ABC-2 transporter; IPR025529 = Protein of unknown function DUF4416; IPR008274 = Aldehyde oxidase/xanthine dehydrogenase, molybdopterin binding; IPR008338 = Capsule biosynthesis protein CapC; IPR021865 = Peptidase G2, IMC autoproteolytic cleavage domain; IPR025636 = Protein of unknown function DUF4294; IPR032585 = Protein of unknown function DUF4912; IPR016905 = Glycyl radical enzyme, HI0521, predicted; IPR008840 = Siphovirus Gp157; IPR025127 = Protein of unknown function DUF4054; IPR006783 = Transposase, ISC1217; IPR028993 = RecG, N-terminal antiparallel four helix bundle; IPR025338 = Protein of unknown function DUF4244; IPR023180 = Tetrahydrodipicolinate-N-succinyltransferase, chain A, domain 1; IPR003688 = Type IV secretion system protein TraG/VirD4; IPR024590 = RNA helicase HrpA, C-terminal; IPR007430 = Bacterial virulence protein VirB8; IPR005498 = Type IV secretion system, VirB10 / TraB / TrbI; IPR010258 = Conjugal transfer, TrbG/VirB9/CagX; IPR010575 = KorB, C-terminal