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| --- | --- | --- | --- |
| **Comparison Groups** | **Sampling Weeks** | **Pseudo-f-statistics** | **p-value** |
| 1Vaccinated (Vx) and challenged (Ch) calves: VxE-Ch vs VxC-Ch | Wk 0 | 1.13 | 0.4 |
| Wk 1 | 1.23 | 0.17 |
| Wk 4 | 0.83 | 0.6 |
| Wk 5 | 0.82 | 0.74 |
| Wk 7 | 1.01 | 0.49 |
| Wk 8 | 1.16 | 0.14 |
| Wk 9 | 0.98 | 0.49 |
| Wk 10 | 1.11 | 0.34 |
| Wk 11 | 1.04 | 0.43 |
| All Vaccinated vs All Non-Vaccinated calves | Wk 0 | 1.0 | 0.39 |
| Wk 1 | 1.05 | 0.35 |
| Wk 4 | 1.1 | 0.28 |
| Wk 5 | 2.69 | 0.01 |
| Wk 7 | 1.63 | 0.05 |
| Non-Vaccinated and Non-Challenged (NonVx-NonCh) vs All Vaccinated and Challenged (Vx-Ch) calves | Wk 7 | 1.96 | 0.00 |
| Wk 8 | 1.67 | 0.01 |
| Wk 9 | 3.92 | 0.00 |
| Wk 10 | 3.7 | 0.00 |
| Wk 11 | 3.78 | 0.00 |
| Non-Vaccinated and Challenged (NonVx-Ch) vs All Vaccinated and Challenged (Vx-Ch) calves | Wk 7 | 2.33 | 0.00 |
| Wk 8 | 1.69 | 0.00 |
| Wk 9 | 3.2 | 0.00 |
| Wk 10 | 4.65 | 0.00 |
| Wk 11 | 3.07 | 0.00 |

**S1 Table. PERMANOVA Analysis of Microbial Diversity**

1 Vaccinated and challenged calves included two groups, one group vaccinated with the vaccine formulation containing adjuvant Emulsigen-D (VxE-Ch) and the other group vaccinated with the vaccine formulation containing adjuvant Carbigen (VxC-Ch).