Table S1: Chemical composition of grass hay, concentrate and barley sprout use during the experiment.

Nutrients	Grass hays	Concentrate	Barley sprout.
DM (%)	92.80	89.63	26.90
		(g/kg)	
CP (%DM)	4.81	15.00	16.60
EE (%DM)	1.60	4.25	3.40
NDF (%DM)	75.91	26.49	31.70
ADF (%DM)	70.49	17.33	10.60
Ash (%DM)	3.72	6.88	2.90

Table S2: Relative abundance of rumen bacteria at phylum level of meat-master lambs and the ratio between *Bacteroidota* and *Firmicute* phyla.

Phyla	T1	T2	T3	SEM	*p*-Value
Actinobacteriota	0.90	1.75	2.25	0.351	0.08
Armatimonadota	0.11	0.19	0.16	0.044	0.48
Bacteroidota	37.27	14.91	19.10	10.435	0.37
Bdellovibrionota	10.70	5.37	0.308	4.535	0.34
Campylobacterota	0.20	0.58	0.32	0.154	0.29
Chloroflexi	0.25	0.19	0.59	0.166	0.26
Cyanobacteria	0.27	0.26	0.56	0.171	0.26
Desulfobacterota	1.47	1.07	1.65	0.643	0.81
Elusimicrobiota	4.70	1.49	7.05	3.261	0.52
Euryarchaeota	0.08	0.15	0.16	0.050	0.52
Fibrobacterota	0.24	0.25	0.30	0.079	0.88
Firmicutes	27.02	52.88	35.43	10.186	0.26
Fusobacteriota	0.38	0.30	0.50	0.172	0.73
Halobacterota	0.27	0.10	0.14	0.068	0.25
Myxococcota	0.34	0.51	0.14	0.181	0.41
Patescibacteria	0.46	0.50	1.00	0.162	0.09
Planctomycetota	0.93	1.94	0.80	0.345	0.11
Proteobacteria	9.23	12.74	10.63	4.640	0.88
SAR324 clade(Marine group B)	0.25	0.13	0.18	0.096	0.69
Spirochaetota	1.68	1.70	0.66	0.751	0.57
Synergistota	0.17	0.23	0.73	0.190	0.15
Thermoplasmatota	0.35	0.24	0.71	0.193	0.28
Verrucomicrobiota	2.65	2.41	2.95	0.992	0.93
WPS-2	0.08	0.10	3.67	1.773	0.32
Bacteroidota:Firmicute ratio	0.75	8.4	2.25	3.557	0.34

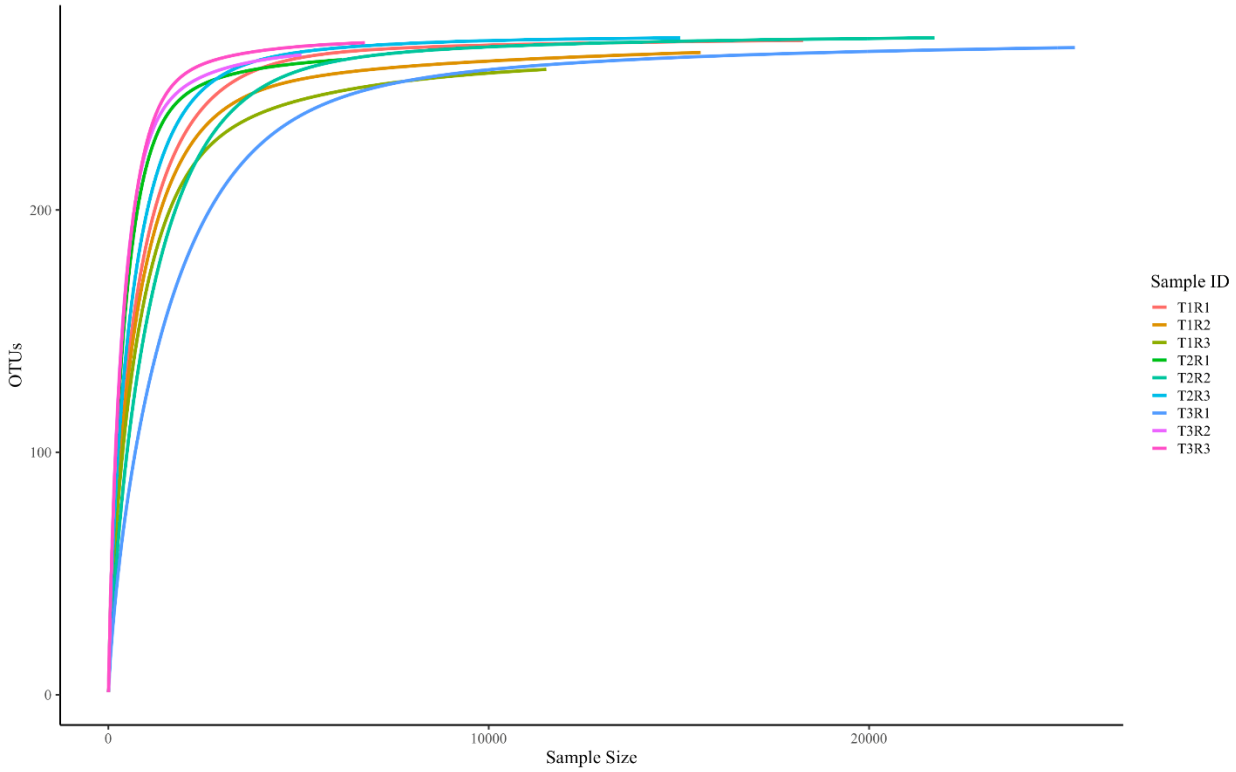
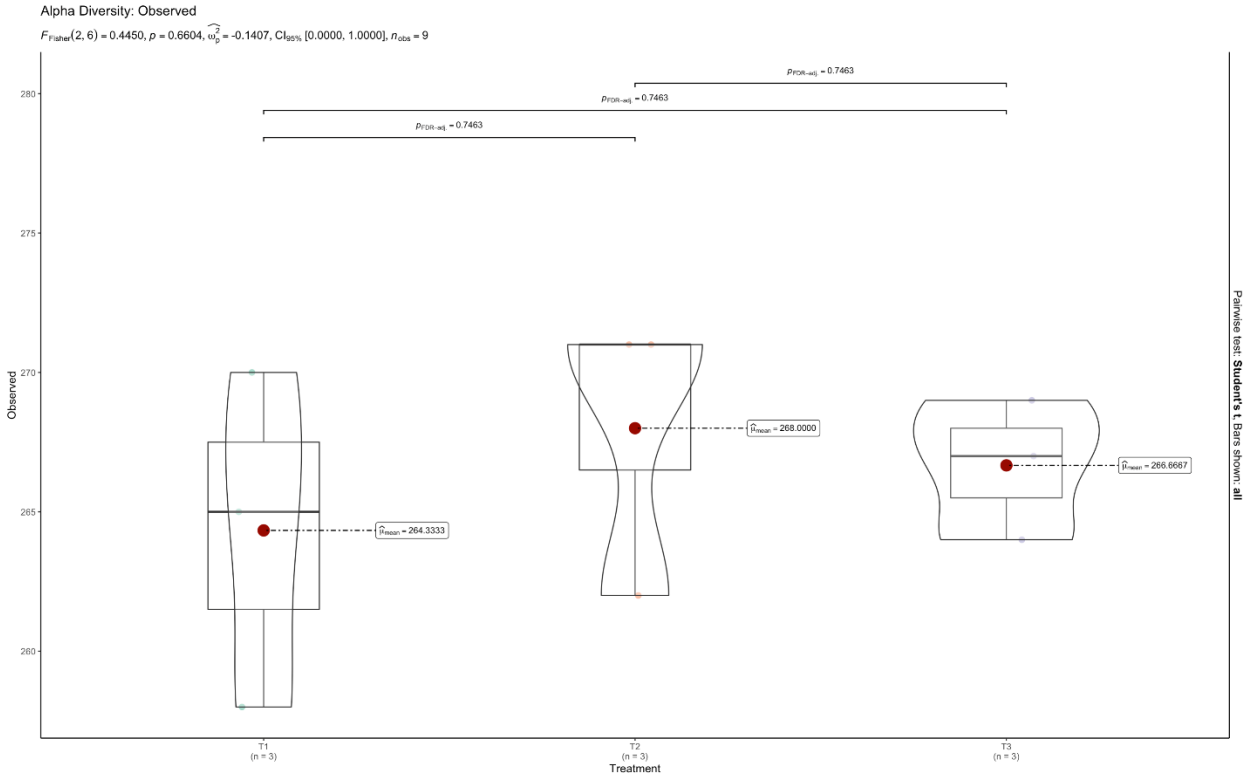
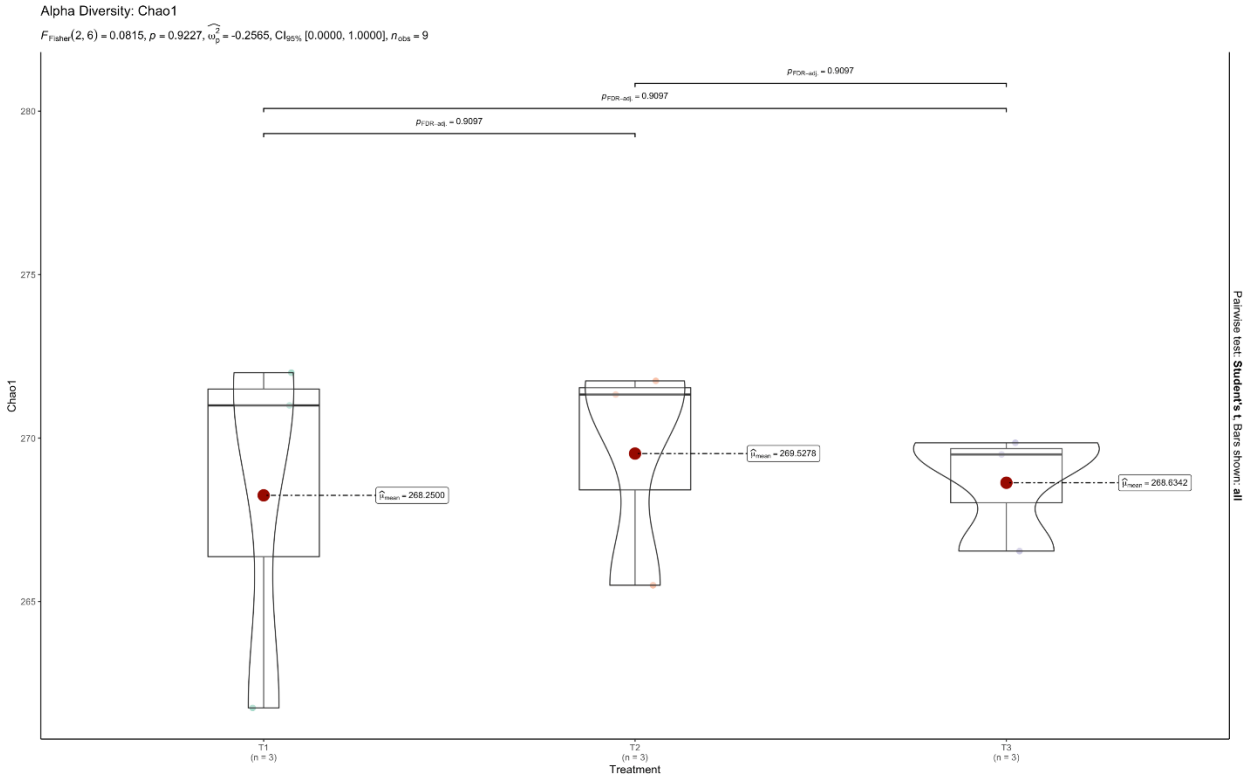
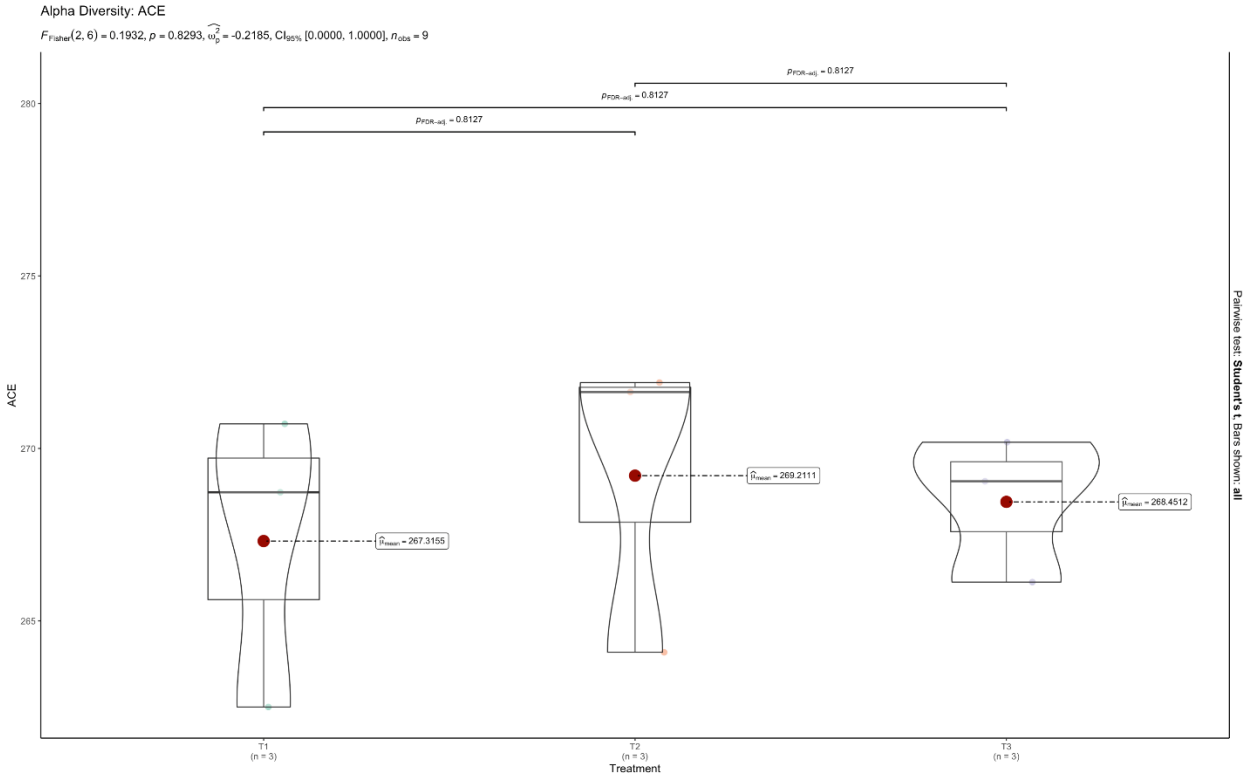


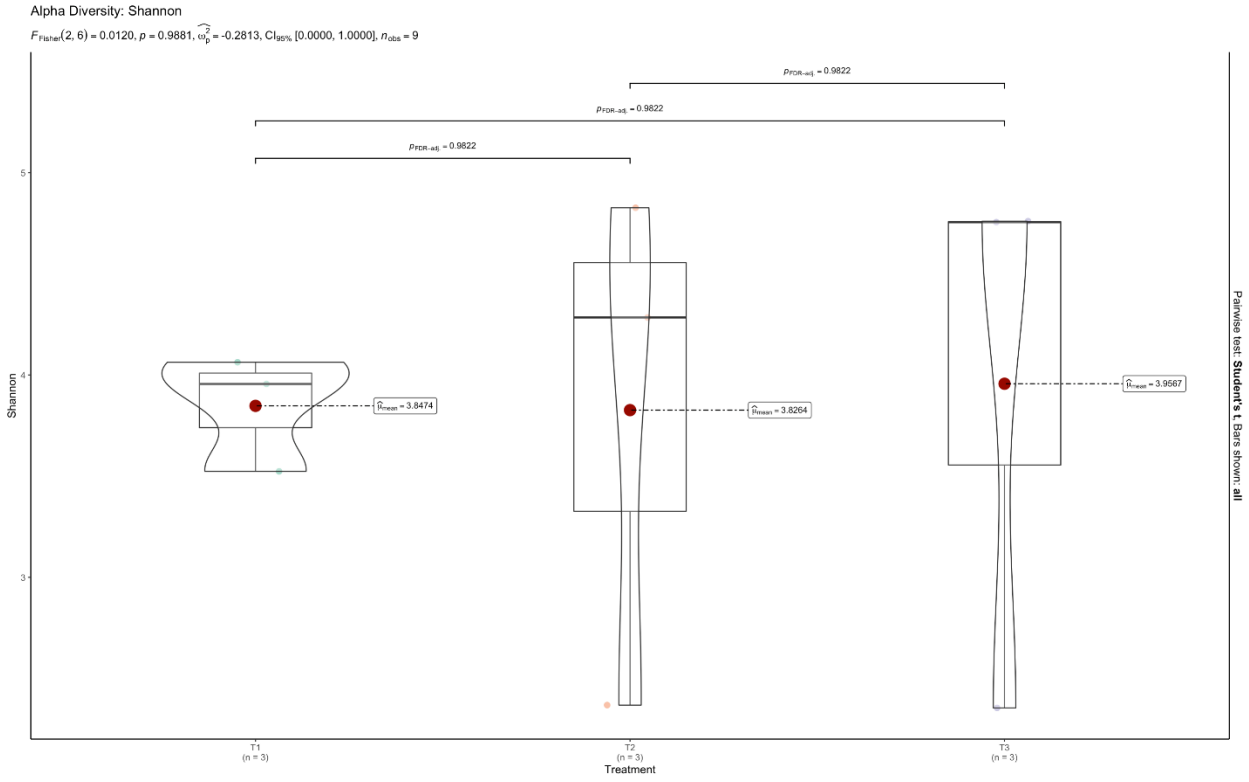
Figure S1: Rarefaction curves of operation taxonomic units based on 16SrRNA sequencing.


Alpha Diversity: Observed
$F_{Fisher}(2, 6) = 0.4450$, $p = 0.6604$, $\widehat{\omega_p^2} = -0.1407$, $CI_{95\%}$ [0.0000, 1.0000], $n_{obs} = 9$
$p_{FDR-adj.} = 0.7463$
$p_{FDR-adj.} = 0.7463$
$p_{FDR-adj.} = 0.7463$
Observed
280
275
270
265
260
$\hat{\mu}_{mean} = 264.3333$
$\hat{\mu}_{mean} = 268.0000$
$\hat{\mu}_{mean} = 266.6667$
T1
(n = 3)
T2
(n = 3)
T3
(n = 3)
Treatment
Pairwise test: Student's t, Bars shown: all

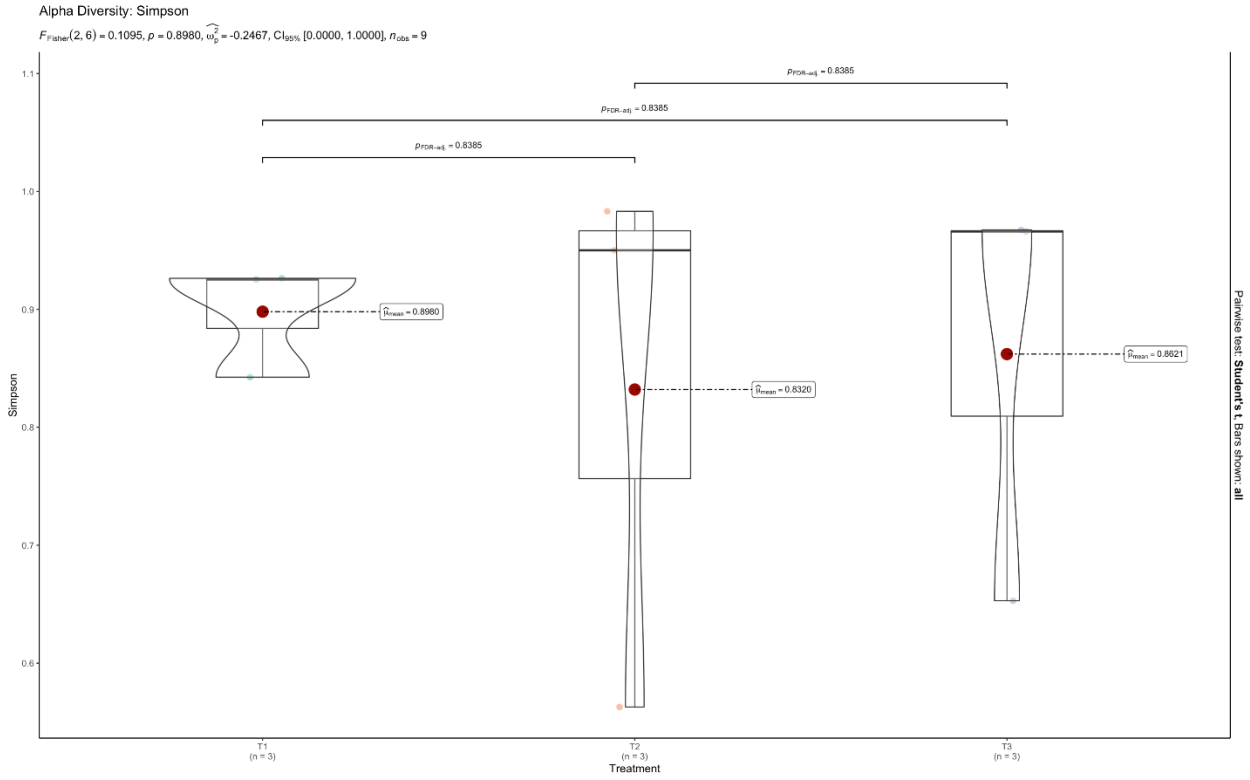

Alpha Diversity: Chao1
$F_{Fisher}(2, 6) = 0.0815$, $p = 0.9227$, $\widehat{\omega_p^2} = -0.2565$, $CI_{95\%}$ [0.0000, 1.0000], $n_{obs} = 9$
$p_{FDR-adj.} = 0.9097$
$p_{FDR-adj.} = 0.9097$
$p_{FDR-adj.} = 0.9097$
Chao1
280
275
270
265
$\hat{\mu}_{mean} = 268.2500$
$\hat{\mu}_{mean} = 269.5278$
$\hat{\mu}_{mean} = 268.6342$
T1
(n = 3)
T2
(n = 3)
T3
(n = 3)
Treatment
Pairwise test: Student's t, Bars shown: all

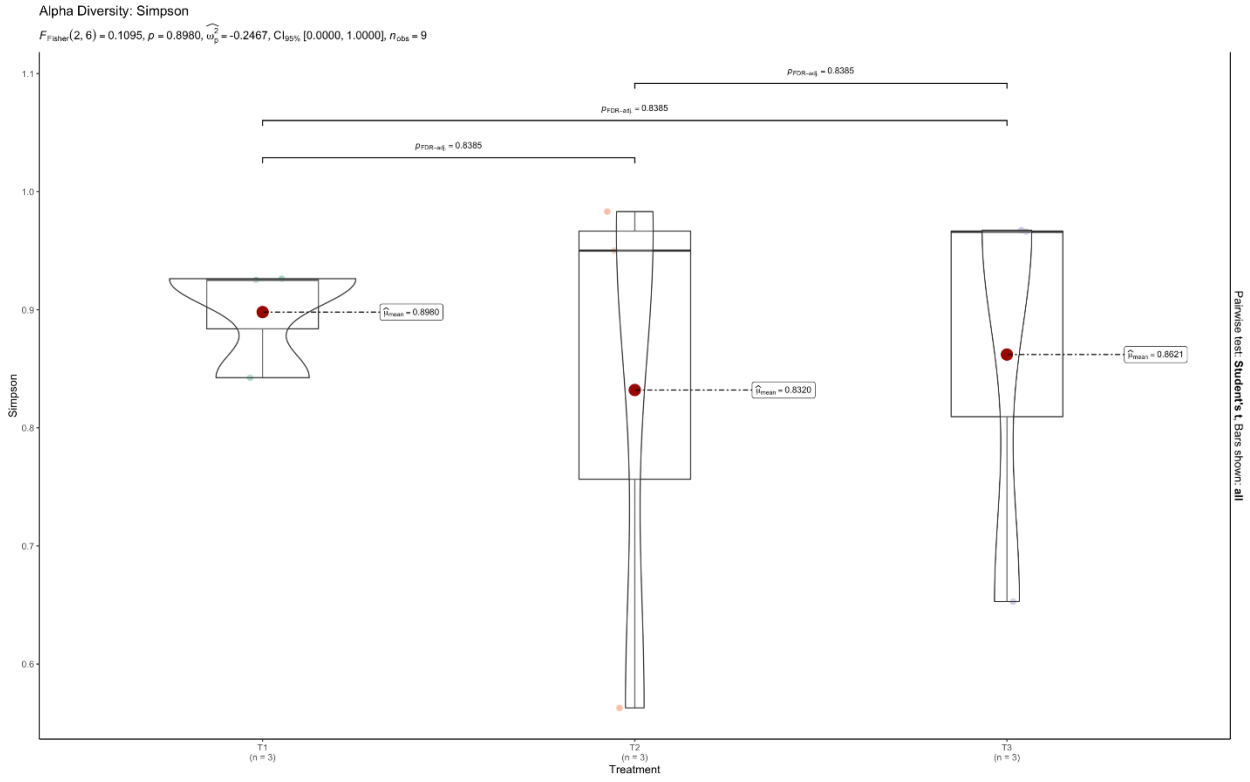
(a)


Alpha Diversity: ACE
$F_{Fisher}(2, 6) = 0.1932$, $p = 0.8293$, $\widehat{\omega_p^2} = -0.2185$, $CI_{95\%}$ [0.0000, 1.0000], $n_{obs} = 9$
$p_{FDR-adj.} = 0.8127$
$p_{FDR-adj.} = 0.8127$
$p_{FDR-adj.} = 0.8127$
ACE
280
275
270
265
$\hat{\mu}_{mean} = 267.3155$
$\hat{\mu}_{mean} = 269.2111$
$\hat{\mu}_{mean} = 268.4512$
T1
(n = 3)
T2
(n = 3)
T3
(n = 3)
Treatment
Pairwise test: Student's t, Bars shown: all

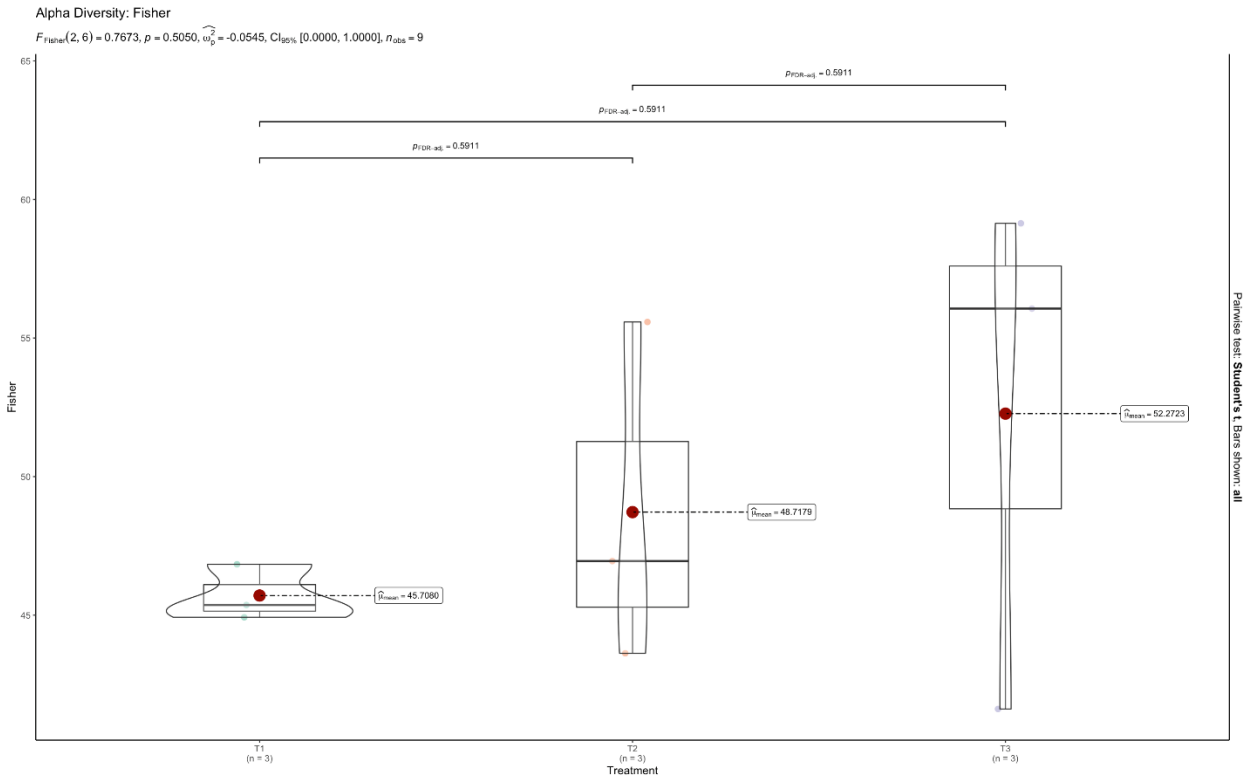

Alpha Diversity: Shannon
$F_{Fisher}(2, 6) = 0.0120$, $p = 0.9881$, $\widehat{\omega_p^2} = -0.2813$, $CI_{95\%}$ [0.0000, 1.0000], $n_{obs} = 9$
$p_{FDR-adj.} = 0.9822$
$p_{FDR-adj.} = 0.9822$
$p_{FDR-adj.} = 0.9822$
Shannon
5
4
3
$\hat{\mu}_{mean} = 3.8474$
$\hat{\mu}_{mean} = 3.8264$
$\hat{\mu}_{mean} = 3.9567$
T1
(n = 3)
T2
(n = 3)
T3
(n = 3)
Treatment
Pairwise test: Student's t, Bars shown: all

(b)


Alpha Diversity: Simpson
$F_{Fisher}(2, 6) = 0.1095$, $p = 0.8980$, $\widehat{\omega_p^2} = -0.2467$, $CI_{95\%}$ [0.0000, 1.0000], $n_{obs} = 9$
$p_{FDR-adj} = 0.8385$
$p_{FDR-adj} = 0.8385$
$p_{FDR-adj} = 0.8385$
$\hat{\mu}_{mean} = 0.8980$
$\hat{\mu}_{mean} = 0.8320$
$\hat{\mu}_{mean} = 0.8621$
Simpson
1.1
1.0
0.9
0.8
0.7
0.6
T1
(n = 3)
T2
(n = 3)
T3
(n = 3)
Treatment
Pairwise test: Student's t, Bars shown: all


Alpha Diversity: Simpson
$F_{Fisher}(2, 6) = 0.1095$, $p = 0.8980$, $\widehat{\omega_p^2} = -0.2467$, $CI_{95\%}$ [0.0000, 1.0000], $n_{obs} = 9$
$p_{FDR-adj} = 0.8385$
$p_{FDR-adj} = 0.8385$
$p_{FDR-adj} = 0.8385$
$\hat{\mu}_{mean} = 0.8980$
$\hat{\mu}_{mean} = 0.8320$
$\hat{\mu}_{mean} = 0.8621$
Simpson
1.1
1.0
0.9
0.8
0.7
0.6
T1
(n = 3)
T2
(n = 3)
T3
(n = 3)
Treatment
Pairwise test: Student's t, Bars shown: all

(c)



(d)

Figure S2: Alpha diversity analysis for Observed, Chaol (a). Alpha diversity analysis for ACE, Shannon (b). Alpha diversity analysis for Simpson, InvSimpson (c). Alpha diversity analysis for Fisher (d).

Table S3: Pearson correlation analysis between relative abundance of bacterial phyla and VFAs, methane and body weight.

Phylum	Me (ppm)[1]	Me (g/day)[2]	Me (g/kgBW)[3]	Me (g/DMI)[4]	FBW[5]	Acetate	Prop[6]	A:P ratio	Isobut[7]	Buty[8]	IsoVa[9]	Valerate	NH_3-N
Actinobacteriota	-0.20	-0.20	-0.46	-0.20	0.59	-0.58	0.08	-0.65	0.35	0.19	-0.32	0.11	-0.68*
Bacteroidota	0.02	-0.02	0.12	-0.02	-0.15	0.17	-0.27	0.36	-0.42	-0.50	0.04	-0.63	0.35
Bdellovibrionota	0.11	0.11	0.25	0.11	-0.16	0.07	-0.33	0.35	0.15	-0.30	0.43	0.07	0.62
Desulfobacterota	-0.20	-0.20	-0.13	-0.20	-0.82**	-0.35	-0.66	0.78**	-0.64	-0.15	-0.42	-0.34	0.14
Elusimicrobiota	0.09	0.09	-0.19	0.09	0.21	-0.18	-0.30	0.09	-0.41	-0.29	-0.33	-0.46	0.04
Firmicutes	0.16	0.16	0.01	0.16	0.13	-0.10	0.54	-0.52	0.33	0.45	0.09	0.69*	-0.47
Patescibacteria	-0.46	-0.46	-0.60	-0.46	0.40	-0.21	0.5	-0.31	-0.85**	0.43	-0.74*	-0.23	-0.46
Planctomycetota	-0.00	-0.00	-0.14	-0.00	0.29	-0.06	0.25	-0.25	0.47	0.08	0.47	0.74*	-0.16
Proteobacteria	-0.16	-0.16	-0.07	-0.16	-0.12	0.24	0.08	0.10	0.25	0.61	-0.21	0.21	-0.16
Spirochaetota	0.02	0.02	0.08	0.02	0.03	-0.15	-0.34	0.17	0.15	-0.37	0.49	0.19	0.40
Verrucomicrobiota	-0.54	-0.54	-0.48	-0.54	-0.13	0.22	-0.01	0.27	-0.10	0.55	-0.66	0.04	0.03
WPS-2	-0.25	-0.25	-0.16	-0.25	0.22	-0.44	-0.15	-0.32	-0.36	-0.32	-0.14	-0.46	-0.36

* = $p \leq 0.05$, **$p < 0.01$

[1]= Methane (ppm), [2] = Methane (g/day), [3] = Methane (g/kg BW), [4] = Methane g/DMI, [5] = Final body weight, [6] = propionate, [7] = Iso-butyrate, [8] = Butyrate, [9] = Iso-Valerate.