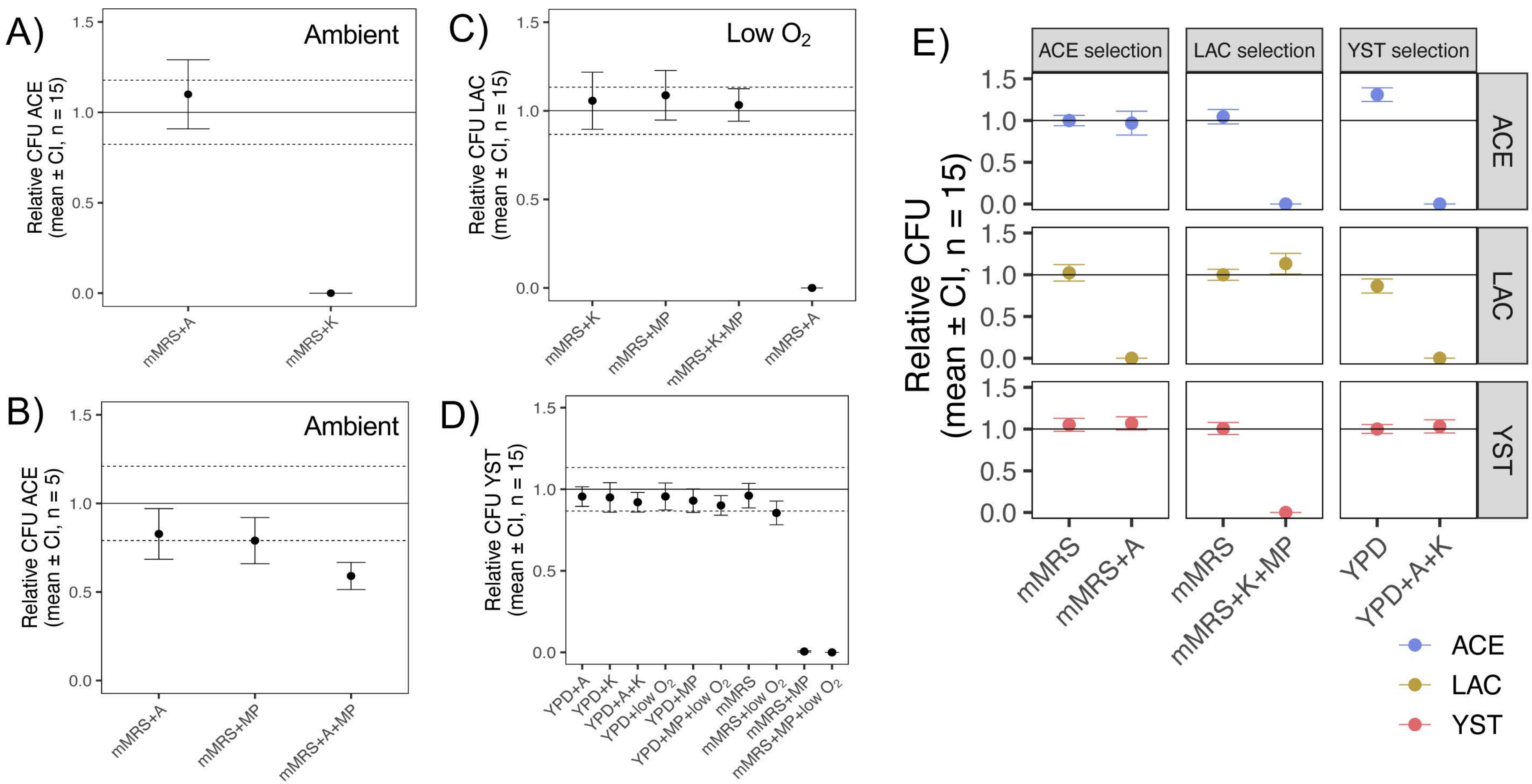


Fig S1 Method development for microbial selection media. Assessment of antimicrobials selected to inhibit (A & B) ACE, (C) LAC, and (D) YST using mono-cultures. (E) Validation of media and antimicrobials used to select for ACE, LAC, and YST using tri-culture community to calculate microbial abundance. Data represents five replicates from three independent experimental replicates, except for panel (B), which had one experimental replicate. CFU was normalized to CFU of microbe grown under optimal conditions (see Table 1). The mean and 95% confidence intervals of positive control are shown as lines for each panel (solid and dashed, respectively). Non-overlapping confidence intervals indicate significant difference between treatments. K = kanamycin. A = ampicillin. MP = methylparaben.

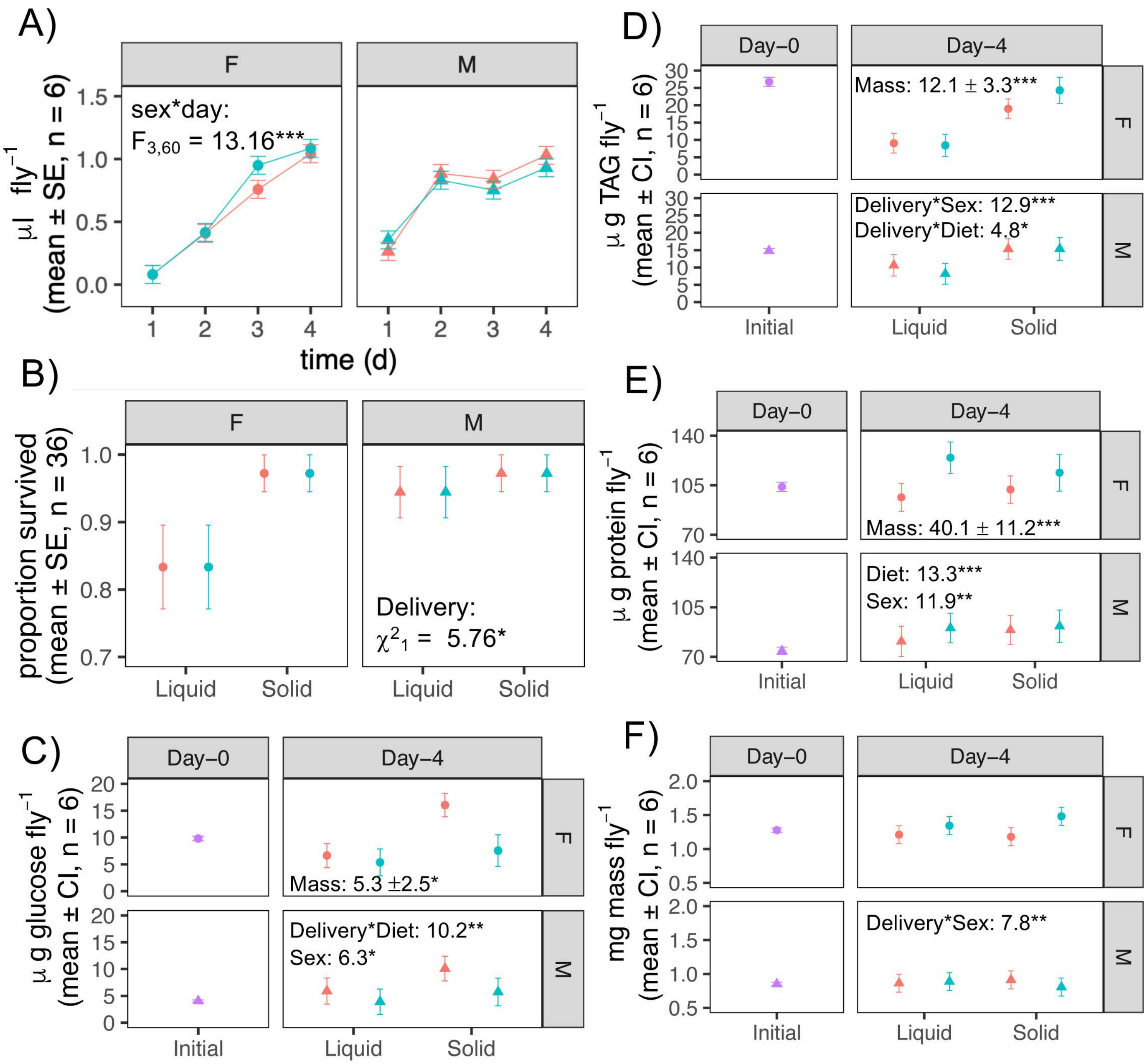
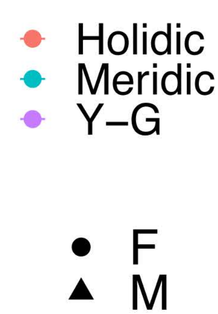


Fig S2. Method development for capillary feeding experiments. Comparison of diet (holidic v. meridic) and delivery method (liquid or solid) on fly (A) feeding rate, (B) survival, nutritional indices ((C) glucose, (D) TAG, and (E) protein content), and fly weight for female (F) and male (M) flies. All data are displayed as estimated marginal mean and SE or CI, except for the raw mean and SE are shown for survival data. For nutritional indices and fly weight, day-0 raw mean and CI are shown for starting reference. The significant effect terms from models are displayed for each panel (significant main effects are not included if interaction term is significant). Panels C-F, the residual degrees of freedom are 39 and the fly weight covariate slope and SE are included under the day-4 label. Note: for solid medium, there is no direct measure of fly feeding as for the CAFÉ method. Significance: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.



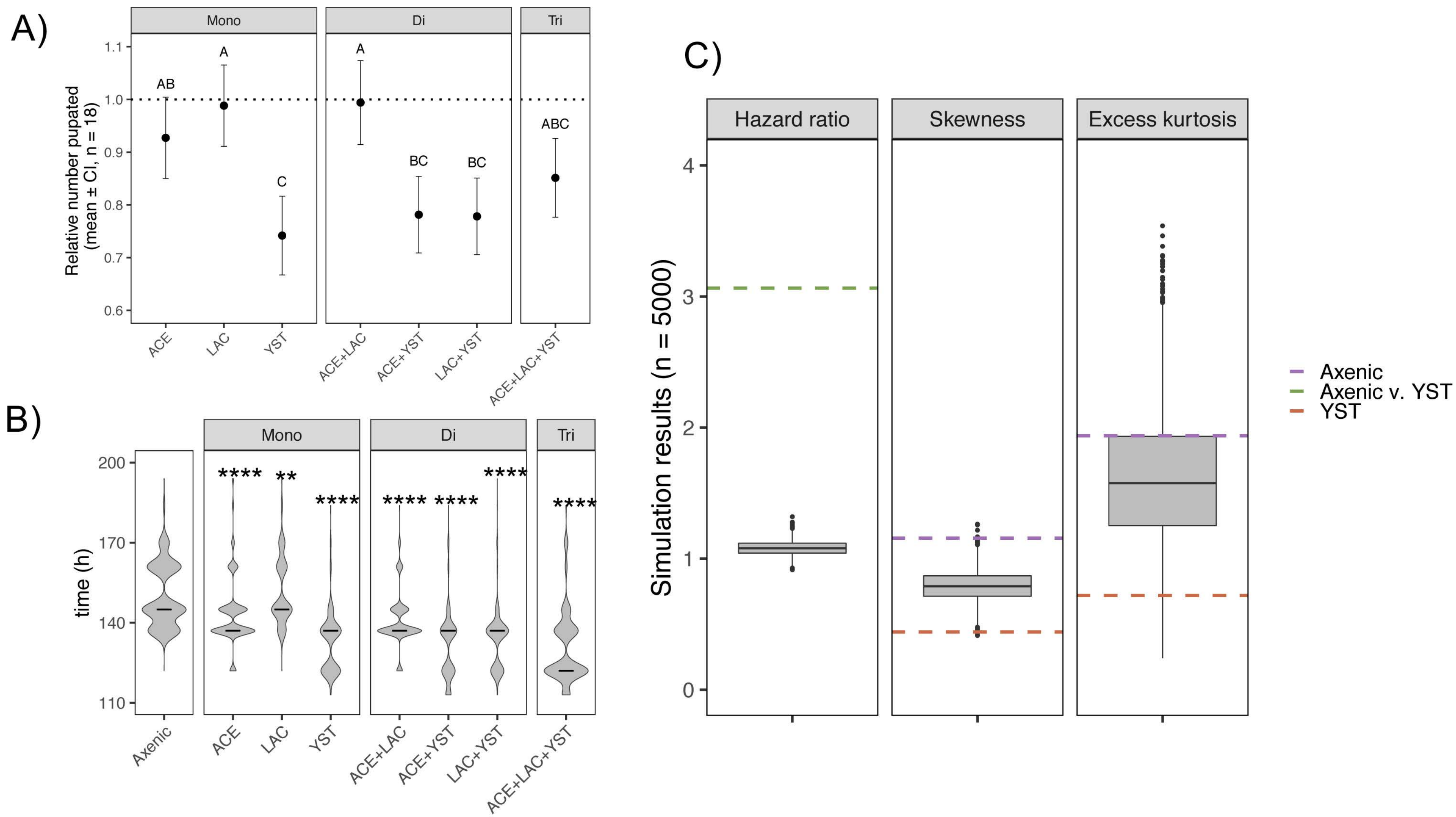


Fig. S3. Analyses of *Drosophila* development time. (A) Relative number of insects pupated, (B) violin plot for time to pupation, and (C) summary statistics of simulated YST time to eclosion. In panel (A), the estimated marginal mean and 95% confidence intervals from ANOVA analysis are plotted, along with letter rankings from *post hoc* Tukey tests. The dashed line is the average value for axenic flies; confidence intervals that do not overlap with this line indicate a significant difference from axenic insects. Probability density function and median time (black bar) are shown for the time to pupation in panel (B). Asterisks indicated significance for Kolmogorov-Smirnov test ** < 0.01 and **** < 0.0001. Statistics for ANOVA treatment effect: $F_{6,110} = 7.40$, $p = 1.15 \times 10^{-6}$, $R^2 = 0.29$. Distribution statistics are in Table S1C. For panel (C), hazard ratio from Cox regression comparing simulated YST eclosion time to axenic data and measures of distribution shape (skewness and excess kurtosis) are shown from all 5,000 simulations. The dashed lines indicate results from observed data distributions to compare how the simulations performed against the observed data. For Cox regression analyses, only 22% of simulations had significant results. The variation in hazard ratios was low across simulations (relative standard deviation [RSD] = 5.2%), and the median time for all YST simulations was equal to the axenic flies (observed axenic and YST median time, 242 and 233 h, respectively) with increased measures of skewness and kurtosis. Simulated YST data indicates that if all flies reached eclosion, it is likely that this would result in an eclosion rate similar to the observed axenic fly data. Mono = mono-association. Di = di-association. Tri = tri-association.

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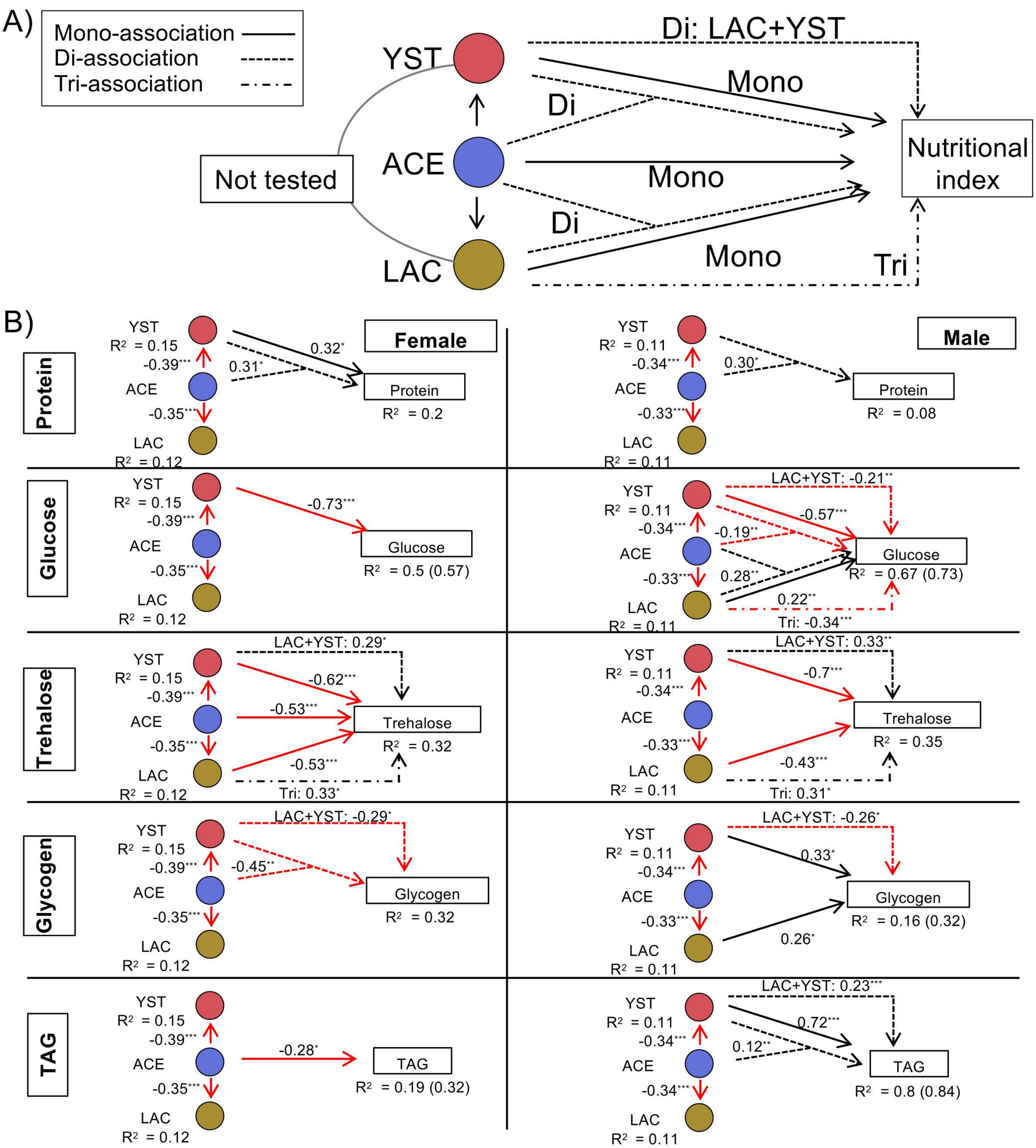

Fig. S4. Nutritional indices. (A) Generalized path analysis model tested to understand among-microbe interactions and their effect on a given nutritional index and (B) association of among-microbe interactions with nutritional indices. Most models did not include a random effect for experimental replicate (p > 0.05), expect for some of the linear models associating a nutritional index to among-microbe interactions (e.g. TAG ~ ACE*LAC*YST). These models include glucose content (both sexes), glycogen content (males only), and TAG content (both sexes). For Fig. 4 and S4B, both the marginal and conditional R^2 are reported for the nutritional index response variable. For panel B, left- and right-side are female and male flies, respectively. Red and black arrows indicate negative and positive associations, respectively. The standardized coefficient for each significant association and marginal R^2 values for all response variables are shown, with conditional R^2 values shown in parentheses if needed. Full description of statistical tests are in Table S1E.

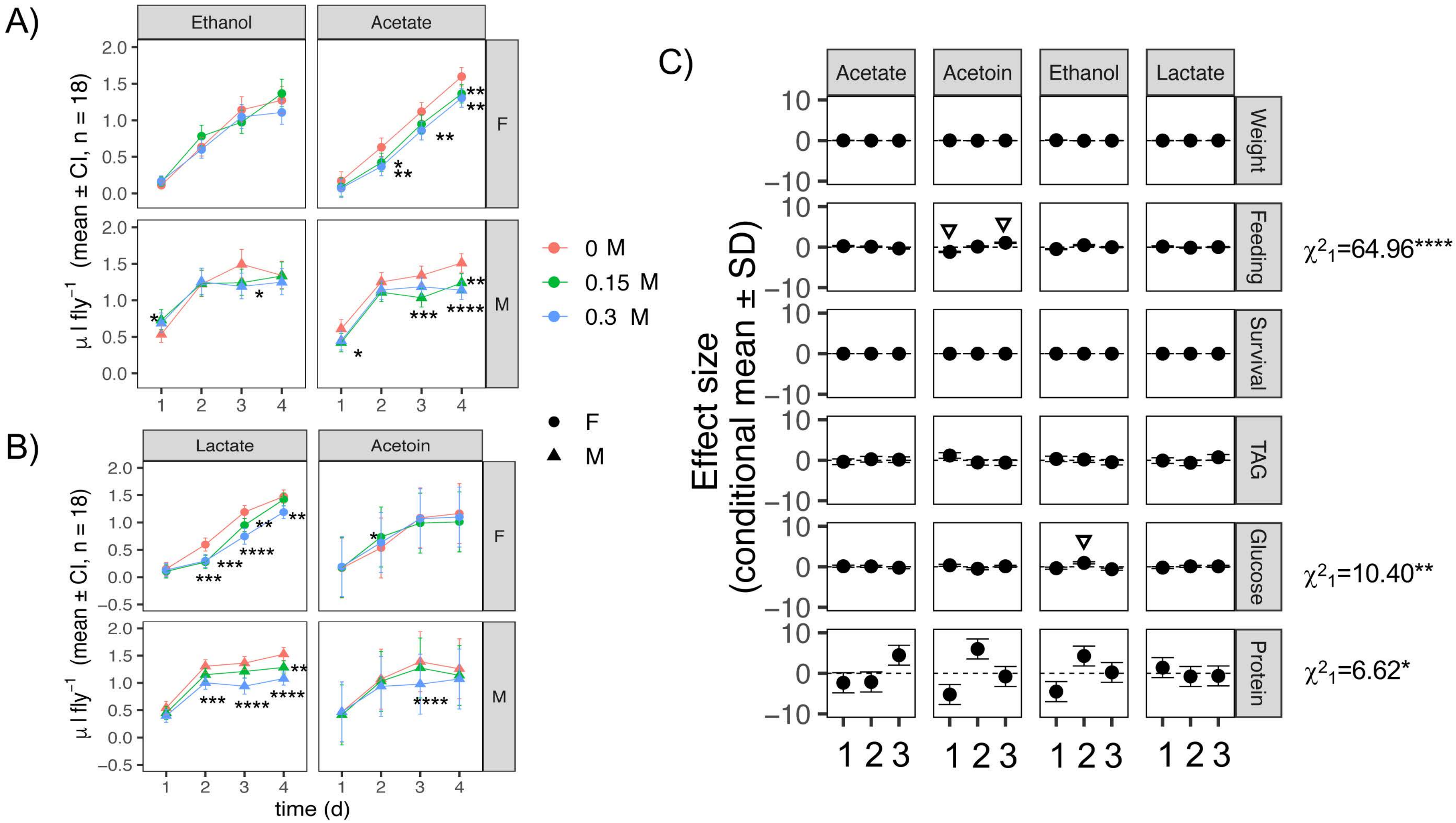

Fig. S5. Performance and nutritional indices of *Drosophila* in CAFÉ assays. Feeding rates of flies administered (A) ethanol, (A) acetate, (B) lactate or (B) acetoin. (C) Comparison of variation between independent experimental replicates for the measures: fly weight, total diet volume consumed by day-4 (Feeding), survival at day-4 (Survival), and nutritional indices for TAG, glucose, and protein content. For panels A and B, the estimated marginal mean and confidence interval are plotted from ANOVA model. *Post hoc* Dunnett's test was used to compare treatments (0.15 and 0.3 M) to control diet for each day and sex (significance: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, **** $p < 0.0001$). Effect test results in Table S1F. For panel C, experimental replicates are labeled as 1, 2, and 3 for each metabolite. Data are displayed as estimated conditional mean and standard deviation for experimental replicate random effect from each model. The dashed line indicates the grand mean. Significant effect terms from each model are shown next to measure label (significance: * $p < 0.05$, ** $p < 0.01$, **** $p < 0.0001$). Open-triangle indicates experimental replicates that differ from grand mean as determined by non-overlapping 95% confidence intervals from simulated posterior distributions (note: no differences were found for protein content in the *post hoc* analysis). F = female. M = male. See Dyrad (doi: 10.5061/dryad.ngf1vhhrj) for extended version of this figure with data displayed from all associated measures in CAFÉ assays.

Table S1A. Effect of co-associations on microbial abundance and biomass

Analysis categories	**ACE**	**LAC**	**YST**	**Total abundance**	**Total biomass**
Tukey test					
ACE-F	B	-	-	B	C
ACE-M	ab	-	-	ab	bc
LAC-F	-	A	-	B	BC
LAC-M	-	a	-	bc	bc
YST-F	-	-	A	CD	A
YST-M	-	-	a	d	a
ACE+LAC-F	A	D	-	A	B
ACE+LAC-M	a	d	-	a	b
ACE+YST-F	C	-	B	D	D
ACE+YST-M	c	-	b	cd	c
LAC+YST-F	-	B	A	BC	A
LAC+YST-M	-	b	a	bcd	a
ACE+LAC+YST-F	C	C	B	CD	CD
ACE+LAC+YST-M	bc	c	b	bcd	c
ANOVA Effect test					
Treatment	**$F_{3,60.} = 31.58$, $p = 2.2 \times 10^{-12}$**	**$F_{3,60.} = 231.69$, $p < 2.2 \times 10^{-16}$**	**$F_{3,64.} = 198.01$, $p < 2.2 \times 10^{-16}$**	**$F_{6,108.04} = 17.23$, $p = 6.80 \times 10^{-14}$**	**$F_{6,106.73} = 48.20$, $p < 2.2 \times 10^{-16}$**
Sex	**$F_{1,62} = 5.51$, $p = 0.0221$**	$F_{1,62} = 3.53$, $p = 0.0650$	**$F_{1,66} = 9.60$, $p = 0.0029$**	**$F_{1,110} = 33.23$, $p = 7.59 \times 10^{-8}$**	**$F_{1,107.43} = 40.74$, $p = 4.52 \times 10^{-9}$**
Interaction	$F_{3,62} = 2.74$, $p = 0.0506$	$F_{3,62} = 1.12$, $p = 0.3469$	**$F_{3,66} = 13.25$, $p = 7.2 \times 10^{-7}$**	**$F_{6,110} = 2.55$, $p = 0.0236$**	**$F_{6,107.50} = 4.21$, $p = 0.0008$**
Analysis of Deviance					
Experimental replicate (Vial)	**$X^2_2 = 29.71$, $p = 3.5 \times 10^{-7}$**	$X^2_2 = 0$, $p = 1$	**$X^2_2 = 20.92$, $p = 2.9 \times 10^{-5}$**	**$X^2_2 = 23.34$, $p = 8.53 \times 10^{-6}$**	**$X^2_2 = 30.59$, $p = 2.27 \times 10^{-7}$**
R^2					
Marginal	0.404	0.843	0.848	0.398	0.632
Conditional	0.682	0.843	0.922	0.632	0.797

The *post hoc* Tukey test was implemented to assess differences in microbial abundance between treatments for each sex. Uppercase letters are used to represent the ranking of female samples and lowercase letters are used to distinguish the rankings for male samples. A hyphen indicates treatment-sex combinations that were not used in species-specific analyses. P-values below the threshold are bolded.

Table S1B. Mixed effect Cox regression model results for influence of microbiota treatment on development time

i) Time to pupation: Axenic reference				
Treatment	Coefficient ± SE[a]	Hazard Ratio	z-value	p-value
ACE	**0.383 ± 0.090**	**1.466**	**4.26**	**< 0.0001**
LAC	-0.067 ± 0.091	0.935	-0.74	0.46
YST	**1.231 ± 0.089**	**3.426**	**13.87**	**< 0.0001**
ACE+LAC	**0.618 ± 0.091**	**1.856**	**6.79**	**< 0.0001**
ACE+YST	**1.298 ± 0.087**	**3.663**	**14.91**	**< 0.0001**
LAC+YST	**1.150 ± 0.087**	**3.157**	**13.28**	**< 0.0001**
ACE+LAC+YST	**1.142 ± 0.088**	**3.132**	**12.91**	**< 0.0001**
Analysis of deviance for Experiment(vial): χ^2_2 **= 653.13, p < 2.2 x** 10^{-16}				
ii) Time to eclosion: Axenic reference				
Treatment	Coefficient ± SE[a]	Hazard Ratio	z-value	p-value
ACE	**0.411 ± 0.085**	**1.509**	**4.81**	**< 0.0001**
LAC	-0.014 ± 0.086	0.987	-0.16	0.87
YST	**1.120 ± 0.084**	**3.064**	**13.27**	**< 0.0001**
ACE+LAC	**0.602 ± 0.086**	**1.826**	**6.97**	**< 0.0001**
ACE+YST	**1.378 ± 0.083**	**3.968**	**16.61**	**< 0.0001**
LAC+YST	**1.141 ± 0.082**	**3.129**	**13.87**	**< 0.0001**
ACE+LAC+YST	**1.270 ± 0.083**	**3.559**	**15.26**	**< 0.0001**
Analysis of deviance for Experiment(vial): χ^2_2 **= 367.93, p < 2.2 x** 10^{-16}				

[a]standard error
P-values below the threshold are bolded.

Table S1C. Microbial treatment effect on pupation and eclosion time distribution shape

Treatment	Pupation		Eclosion	
	Skewness	*Kurtosis*	*Skewness*	*Kurtosis*
Axenic	**skew = 0.63154, z = 8.16090, p = 3.324 x 10^{-16}**	**kurt = 2.5632, z = -3.8453, p = 0.0001204**	**skew = 1.1559, z = 13.3350, p < 2.2 x 10^{-16}**	**kurt = 4.9370, z = 7.5279, p = 5.155 x 10^{-14}**
ACE	**skew = 1.4526, z = 13.9400, p < 2.2 x 10^{-16}**	**kurt = 6.5036, z = 9.1271, p < 2.2 x 10^{-16}**	**skew = 1.3758, z = 13.5040, p < 2.2 x 10^{-16}**	**kurt = 5.1519, z = 7.1994, p = 6.05 x 10^{-13}**
LAC	**skew = 0.75575, z = 8.77260, p < 2.2 x 10^{-16}**	kurt = 2.8148, z = -1.2101, p = 0.2263	**skew = 0.995, z = 10.804, p < 2.2 x 10^{-16}**	**kurt = 3.7046, z = 3.5312, p = 0.0004137**
YST	**skew = 1.0856, z = 10.5910, p < 2.2 x 10^{-16}**	**kurt = 5.3998, z = 7.0930, p = 1.313 x 10^{-12}**	**skew = 0.44015, z = 4.91990, p = 8.66 x 10^{-7}**	**kurt = 3.7181, z = 3.2819, p = 0.001031**
ACE + LAC	**skew = 1.077, z = 11.327, p < 2.2 x 10^{-16}**	**kurt = 5.3551, z = 7.5245, p = 5.292 x 10^{-14}**	**skew = 1.7202, z = 15.5100, p < 2.2 x 10^{-16}**	**kurt = 6.8955, z = 9.5624, p < 2.2 x 10^{-16}**
ACE + YST	**skew = 0.82543, z = 9.04410, p < 2.2 x 10^{-16}**	**kurt = 4.2327, z = 5.0514, p = 4.386 x 10^{-7}**	**skew = 0.63815, z = 7.17800, p = 7.073 x 10^{-13}**	kurt = 3.08720, z = 0.63387, p = 0.5262
LAC + YST	**skew = 1.1518, z = 11.6320, p < 2.2 x 10^{-16}**	**kurt = 6.4887, z = 8.9211, p < 2.2 x 10^{-16}**	**skew = 0.51589, z = 5.99600, p = 2.023 x 10^{-9}**	**kurt = 4.4441, z = 5.5318, p = 3.17 x 10^{-8}**
ACE + LAC + YST	**skew = 1.3636, z = 13.3130, p < 2.2 x 10^{-16}**	**kurt = 4.9863, z = 6.8362, p = 8.132 x 10^{-12}**	**skew = 0.35846, z = 4.29100, p = 1.779 x 10^{-5}**	kurt = 2.7491, z = -1.6526, p = 0.09842
Kolmogorov-Smirnov tests	**Pupation**		**Eclosion**	
	D statistic	***p-value***	***D statistic***	***p-value***
ACE - Axenic	**0.2736**	**< 2.2 x 10^{-16}**	**0.2347**	**< 2.2 x 10^{-16}**
LAC - Axenic	**0.08423**	**0.0010**	0.0311	0.6761
YST - Axenic	**0.5896**	**< 2.2 x 10^{-16}**	**0.5428**	**< 2.2 x 10^{-16}**
ACE + LAC - Axenic	**0.3861**	**< 2.2 x 10^{-16}**	**0.3156**	**< 2.2 x 10^{-16}**
ACE + YST - Axenic	**0.6047**	**< 2.2 x 10^{-16}**	**0.6781**	**< 2.2 x 10^{-16}**
LAC + YST - Axenic	**0.6119**	**< 2.2 x 10^{-16}**	**0.5388**	**< 2.2 x 10^{-16}**
ACE + LAC + YST - Axenic	**0.5740**	**< 2.2 x 10^{-16}**	**0.6081**	**< 2.2 x 10^{-16}**

P-values below the threshold are bolded.

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Table S1D. Effect of microbial treatment and sex on fly weight and nutritional indices

Analysis categories	Weight	Protein	TAG	Glucose	Trehalose	Glycogen
ANOVA Effect test						
Treatment	**$F_{7,122.53}$ = 16.75, p = 2.3 x 10^{-15}**	**$F_{7,124.11}$ = 5.61, p = 1.2 x 10^{-5}**	**$F_{7,124.02}$ = 62.41, p < 2.2 x 10^{-16}**	**$F_{7,124.05}$ = 68.53, p < 2.2 x 10^{-16}**	**$F_{7,124.22}$ = 12.46, p = 5.1 x 10^{-12}**	**$F_{7,124.04}$ = 8.64, p = 1.3 x 10^{-8}**
Sex	**$F_{1,124.02}$ = 4933.70, p < 2.2 x 10^{-16}**	**$F_{1,126}$ = 19.69, p = 2.0 x 10^{-5}**	**$F_{1,126}$ = 43.22, p = 1.2 x 10^{-9}**	**$F_{1,126}$ = 836.85, p < 2.2 x 10^{-16}**	**$F_{1,1126}$= 68.70, p = 1.5 x 10^{-13}**	**$F_{1,126}$ = 376.79, p < 2.2 x 10^{-16}**
Interaction	**$F_{3,124.09}$ = 8.11, p = 4.2 x 10^{-8}**	$F_{7,126}$ = 1.24, p = 0.2848	**$F_{7,126}$ = 36.86, p < 2.2 x 10^{-16}**	**$F_{7,126}$ = 10.08, p = 5.8 x 10^{-10}**	**$F_{7,126}$ = 3.10, p = 0.0047**	**$F_{6,126}$ = 7.19, p = 3.1 x 10^{-7}**
Analysis of Deviance						
Experimental replicate (Vial)	X^2_2 = 0.72, p = 0.6974	X^2_2 = 3.02, p = 0.221	**X^2_2 = 23.25, p = 8.9 x 10^{-6}**	**X^2_2 = 631.42, p < 2.2 x 10^{-16}**	**X^2_2 = 94.21, p < 2.2 x 10^{-16}**	**X^2_2 = 20.35, p = 3.8 x 10^{-5}**
R^2						
Marginal	0.947	0.211	0.702	0.812	0.394	0.578
Conditional	0.952	0.304	0.747	0.881	0.825	0.704

P-values below the threshold are bolded.

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Table S1E. Structural equation model output for among-microbe interactions and their influence on *Drosophila* nutritional indices.

i) Protein content – Female samples (Fisher's C = 1.295, df = 2, p = 0.523)					
Response	Predictor	Unstandardized coefficient	SE	Standardized coefficient	P value
Protein	ACE	-0.4200	2.0154	-0.0307	0.8352
Protein	LAC	-1.7197	2.0957	-0.0951	0.4134
Protein	**YST**	**5.7954**	**2.2936**	**0.3239**	**0.0127**
Protein	ACE*LAC	-0.2194	1.8894	-0.0179	0.9077
Protein	**ACE*YST**	**3.5765**	**1.7824**	**0.3138**	**0.0469**
Protein	LAC*YST	0.4653	0.9844	0.0626	0.6373
Protein	ACE*LAC*YST	-1.3972	1.5684	-0.1615	0.3747
YST	**ACE**	**-0.2952**	**0.0614**	**-0.3862**	**< 0.0001**
LAC	**ACE**	**-0.2628**	**0.0617**	**-0.3475**	**< 0.0001**
ii) Protein content – Male samples (Fisher's C = 1.045, df = 2, p = 0.593)					
Response	Predictor	Unstandardized coefficient	SE	Standardized coefficient	P value
Protein	ACE	-1.9905	2.8024	-0.1138	0.4788
Protein	LAC	-0.4113	3.0130	-0.0175	0.8916
Protein	YST	2.0101	3.3455	0.0817	0.5490
Protein	ACE*LAC	1.9296	2.8328	0.1265	0.4970
Protein	**ACE*YST**	**4.2620**	**2.0236**	**0.2953**	**0.0372**
Protein	LAC*YST	1.0465	1.4651	0.1030	0.4764
Protein	ACE*LAC*YST	-1.7050	2.3303	-0.1291	0.4657
YST	**ACE**	**-0.2398**	**0.0582**	**-0.3374**	**0.0001**
LAC	**ACE**	**-0.2486**	**0.0611**	**-0.3338**	**0.0001**
iii) Glucose content – Female samples (Fisher's C = 1.295, df = 2, p = 0.523)					
Response	Predictor	Unstandardized coefficient	SE	Standardized coefficient	P value
Glucose	ACE	-0.1082	0.0682	-0.1741	0.1154
Glucose	LAC	0.0148	0.0709	0.0180	0.8350
Glucose	**YST**	**-0.5910**	**0.0777**	**-0.7272**	**< 0.0001**
Glucose	ACE*LAC	0.0764	0.0639	0.1372	0.2346
Glucose	ACE*YST	-0.0795	0.0604	-0.1536	0.1910
Glucose	LAC*YST	-0.0056	0.0333	-0.0166	0.8668
Glucose	ACE*LAC*YST	0.0133	0.0533	0.0338	0.8037
YST	**ACE**	**-0.2952**	**0.0614**	**-0.3862**	**< 0.0001**
LAC	**ACE**	**-0.2628**	**0.0617**	**-0.3475**	**< 0.0001**
iv) Glucose content – Male samples (Fisher's C = 1.045, df = 2, p = 0.593)					
Response	Predictor	Unstandardized coefficient	SE	Standardized coefficient	P value
Glucose	ACE	-0.0504	0.0462	-0.0957	0.2777
Glucose	**LAC**	**0.1550**	**0.0496**	**0.2191**	**0.0022**
Glucose	**YST**	**-0.4220**	**0.0551**	**-0.5693**	**< 0.0001**
Glucose	**ACE*LAC**	**0.1298**	**0.0467**	**0.2825**	**0.0063**
Glucose	**ACE*YST**	**-0.0822**	**0.0333**	**-0.1892**	**0.0150**
Glucose	**LAC*YST**	**-0.0648**	**0.0241**	**-0.2117**	**0.0083**
Glucose	**ACE*LAC*YST**	**-0.1350**	**0.0385**	**-0.3393**	**0.0006**
YST	**ACE**	**-0.2398**	**0.0582**	**-0.3374**	**0.0001**
LAC	**ACE**	**-0.2486**	**0.0611**	**-0.3338**	**0.0001**

v) Trehalose content – Female samples (Fisher's C = 1.295, df = 2, p = 0.523)					
Response	Predictor	Unstandardized coefficient	SE	Standardized coefficient	P value
Trehalose	**ACE**	**-0.2915**	**0.0754**	**-0.5255**	**0.0002**
Trehalose	**LAC**	**-0.3887**	**0.0784**	**-0.5299**	**< 0.0001**
Trehalose	**YST**	**-0.4483**	**0.0858**	**-0.6178**	**< 0.0001**
Trehalose	ACE*LAC	0.1031	0.0707	0.2075	0.1470
Trehalose	ACE*YST	-0.1020	0.0667	-0.2207	0.1286
Trehalose	**LAC*YST**	**0.0884**	**0.0368**	**0.2934**	**0.0178**
Trehalose	**ACE*LAC*YST**	**0.1168**	**0.0587**	**0.3329**	**0.0487**
YST	**ACE**	**-0.2952**	**0.0614**	**-0.3862**	**< 0.0001**
LAC	**ACE**	**-0.2628**	**0.0617**	**-0.3475**	**< 0.0001**
vi) Trehalose content – Male samples (Fisher's C = 1.045, df = 2, p = 0.593)					
Response	Predictor	Unstandardized coefficient	SE	Standardized coefficient	P value
Trehalose	ACE	-0.1052	0.0871	-0.1629	0.2297
Trehalose	**LAC**	**-0.3726**	**0.0937**	**-0.4297**	**0.0001**
Trehalose	**YST**	**-0.6365**	**0.1040**	**-0.7005**	**< 0.0001**
Trehalose	ACE*LAC	-0.0388	0.0881	-0.0690	0.6600
Trehalose	ACE*YST	-0.0661	0.0629	-0.1241	0.2952
Trehalose	**LAC*YST**	**0.1239**	**0.0456**	**0.3302**	**0.0075**
Trehalose	**ACE*LAC*YST**	**0.1495**	**0.0725**	**0.3064**	**0.0412**
YST	**ACE**	**-0.2398**	**0.0582**	**-0.3374**	**0.0001**
LAC	**ACE**	**-0.2486**	**0.0611**	**-0.3338**	**0.0001**
vii) Glycogen content – Female samples (Fisher's C = 1.295, df = 2, p = 0.523)					
Response	Predictor	Unstandardized coefficient	SE	Standardized coefficient	P value
Glycogen	ACE	-0.0724	0.1345	-0.0729	0.5914
Glycogen	LAC	0.1846	0.1399	0.1406	0.1893
Glycogen	YST	-0.1517	0.1531	-0.1168	0.3236
Glycogen	ACE*LAC	0.1448	0.1261	0.1628	0.2530
Glycogen	**ACE*YST**	**-0.3761**	**0.1190**	**-0.4547**	**0.0020**
Glycogen	**LAC*YST**	**-0.1548**	**0.0657**	**-0.2870**	**0.0200**
Glycogen	ACE*LAC*YST	-0.0003	0.1047	-0.0004	0.9979
YST	**ACE**	**-0.2952**	**0.0614**	**-0.3862**	**< 0.0001**
LAC	**ACE**	**-0.2628**	**0.0617**	**-0.3475**	**< 0.0001**
viii) Glycogen content – Male samples (Fisher's C = 1.045, df = 2, p = 0.593)					
Response	Predictor	Unstandardized coefficient	SE	Standardized coefficient	P value
Glycogen	**ACE**	**0.3215**	**0.1371**	**0.3303**	**0.0206**
Glycogen	**LAC**	**0.3444**	**0.1470**	**0.2635**	**0.0207**
Glycogen	YST	-0.1050	0.1634	-0.0766	0.5219
Glycogen	ACE*LAC	-0.0384	0.1384	-0.0453	0.7816
Glycogen	ACE*YST	0.0056	0.0988	0.0069	0.9553
Glycogen	**LAC*YST**	**-0.1444**	**0.0715**	**-0.2553**	**0.0456**
Glycogen	ACE*LAC*YST	-0.0484	0.1141	-0.0659	0.6718
YST	**ACE**	**-0.2398**	**0.0582**	**-0.3374**	**0.0001**
LAC	**ACE**	**-0.2486**	**0.0611**	**-0.3338**	**0.0001**

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ix) TAG content – Female samples (Fisher's C = 1.295, df = 2, p = 0.523)					
Response	Predictor	Unstandardized coefficient	SE	Standardized coefficient	P value
TAG	**ACE**	**-0.8619**	**0.4261**	**-0.2779**	**0.0453**
TAG	LAC	-0.1071	0.4429	-0.0261	0.8094
TAG	YST	0.0214	0.4852	0.0053	0.9648
TAG	ACE*LAC	-0.2136	0.3994	-0.0769	0.5938
TAG	ACE*YST	-0.0476	0.3776	-0.0184	0.8999
TAG	LAC*YST	0.3802	0.2082	0.2256	0.0702
TAG	ACE*LAC*YST	-0.0362	0.3327	-0.0185	0.9135
YST	**ACE**	**-0.2952**	**0.0614**	**-0.3862**	**< 0.0001**
LAC	**ACE**	**-0.2628**	**0.0617**	**-0.3475**	**< 0.0001**
x) TAG content – Male samples (Fisher's C = 0.988, df = 2, p = 0.61)					
Response	Predictor	Unstandardized coefficient	SE	Standardized coefficient	P value
TAG	ACE	0.0026	0.4246	0.0004	0.9952
TAG	LAC	-0.4702	0.4553	-0.0551	0.3037
TAG	**YST**	**6.3893**	**0.5064**	**0.7152**	**< 0.0001**
TAG	ACE*LAC	-0.7518	0.4287	-0.1352	0.0820
TAG	**ACE*YST**	**0.6317**	**0.3061**	**0.1201**	**0.0411**
TAG	**LAC*YST**	**0.8681**	**0.2215**	**0.2344**	**0.0001**
TAG	ACE*LAC*YST	0.6113	0.3535	0.1268	0.0862
YST	**ACE**	**-0.2398**	**0.0582**	**-0.3400**	**0.0001**
LAC	**ACE**	**-0.2486**	**0.0611**	**-0.3369**	**0.0001**

P-values below the threshold are bolded.

Table S1F. Effect of administered microbial fermentation products on *Drosophila* feeding, survival, weight, and nutritional indices

i) Metabolite effect on feeding by day				
ANOVA effect test (Type III ANOVA)	***Ethanol (sqrt-transformed)***	***Acetic acid***	***Lactic acid***	***Acetoin***
Concentration	$F_{2,100} = 1.46$, $p = 0.2362$	**$F_{2,100} = 26.02$, $p = 8.0 \times 10^{-10}$**	**$F_{2,103}$ = , 41.41 $p = 6.4 \times 10^{-14}$**	$F_{2,100} = 2.57$, $p = 0.0817$
Sex	**$F_{1,100} = 204.93$, $p < 2.2 \times 10^{-16}$**	**$F_{1,100} = 114.84$, $p < 2.2 \times 10^{-16}$**	**$F_{1,102} = 138.09$, $p < 2.2 \times 10^{-16}$**	**$F_{1,100} = 50.98$, $p = 1.5 \times 10^{-10}$**
Day	**$F_{3,306} = 318.40$, $p < 2.2 \times 10^{-16}$**	**$F_{3,306} = 388.81$, $p < 2.2 \times 10^{-16}$**	**$F_{3,300} = 138.09$, $p < 2.2 \times 10^{-16}$**	**$F_{3,306} = 301.96$, $p < 2.2 \times 10^{-16}$**
Concentration*Sex	$F_{2,100} = 0.29$, $p = 0.7489$	$F_{2,100} = 0.77$, $p = 0.4668$	$F_{2,102} = 0.73$, $p = 0.4863$	**$F_{2,100} = 3.33$, $p = 0.0397$**
Concentration*Day	**$F_{6,306} = 4.06$, $p = 0.0006$**	$F_{6,306} = 1.33$, $p = 0.2454$	**$F_{6,300} = 4.05$, $p = 0.0006$**	**$F_{6,306} = 2.94$, $p = 0.0084$**
Sex*Day	**$F_{3,306} = 42.62$, $p < 2.2 \times 10^{-16}$**	**$F_{3,306} = 56.17$, $p < 2.2 \times 10^{-16}$**	**$F_{3,301} = 57.15$, $p < 2.2 \times 10^{-16}$**	**$F_{3,306} = 9.49$, $p = 5.2 \times 10^{-6}$**
Concentration*Sex*Day	$F_{6,306} = 1.13$, $p = 0.3462$	$F_{6,306} = 0.96$, $p = 0.4561$	$F_{6,300} = 1.02$, $p = 0.4108$	**$F_{6,306} = 2.18$, $p = 0.0452$**
Analysis of deviance				
Experimental replicate	**$\chi^2_1 = 6.855$, $p = 0.0088$**	$\chi^2_1 = 2.054$, $p = 0.1519$	$\chi^2_1 = 0.561$, $p = 0.4537$	**$\chi^2_1 = 98.164$, $p < 2.2 \times 10^{-16}$**
R^2				
Marginal	0.741	0.765	0.782	0.503
Conditional	0.766	0.792	0.799	0.801
ii) Metabolite effect on final survival				
Effect test (Wald's χ^2)	***Ethanol***	***Acetic acid***	***Lactic acid***	***Acetoin***
Concentration	**$\chi^2_2 = 7.686$, $p = 0.0214$**	**$\chi^2_2 = 11.859$, $p = 0.0027$**	**$\chi^2_2 = 9.470$, $p = 0.0088$**	$\chi^2_2 = 1.575$, $p = 0.4550$
Sex	$\chi^2_1 = 2.148$, $p = 0.1428$	$\chi^2_1 = 0.582$, $p = 0.4457$	**$\chi^2_1 = 6.066$, $p = 0.0138$**	$\chi^2_1 = 0.076$, $p = 0.7834$
Concentration*Sex	$\chi^2_2 = 1.620$, $p = 0.4448$	$\chi^2_2 = 5.382$, $p = 0.0678$	$\chi^2_2 = 2.536$, $p = 0.2815$	$\chi^2_2 = 3.752$, $p = 0.1532$
Total food consumed	$\chi^2_1 = 1.807$, $p = 0.1789$	$\chi^2_1 = 0.000$, $p = 0.9955$	**$\chi^2_1 = 4.535$, $p = 0.0332$**	$\chi^2_1 = 3.146$, $p = 0.0761$
Analysis of deviance				
Experimental replicate	$\chi^2_1 = 0$, $p = 0.9999$	$\chi^2_1 = 2.864$, $p = 0.091$	**$\chi^2_1 = 6.235$, $p = 0.0125$**	$\chi^2_1 = 0$, $p = 0.9992$
iii) Metabolite effect on fly weight				
ANOVA effect test (Type II ANOVA)	***Ethanol (sqrt-transformed)***	***Acetic acid (sqrt-transformed)***	***Lactic acid***	***Acetoin***
Concentration	$F_{2,99} = 0.119$, $p = 0.8883$	**$F_{2,100} = 6.102$, $p = 0.0032$**	$F_{2,87} = 1.434$, $p = 0.2439$	$F_{2,100} = 2.584$, $p = 0.0805$
Sex	**$F_{1,101} = 39.105$, $p = 9.8 \times 10^{-9}$**	**$F_{1,101} = 63.300$, $p = 2.7 \times 10^{-12}$**	**$F_{1,88} = 9.188$, $p = 0.0032$**	**$F_{1,96} = 83.452$, $p = 1.1 \times 10^{-14}$**
Concentration*Sex	$F_{2,99} = 0.892$, $p = 0.4130$	**$F_{2,99} = 4.647$, $p = 0.0118$**	$F_{2,86} = 0.460$, $p = 0.6331$	$F_{2,100} = 0.761$, $p = 0.4699$

Total food consumed	$F_{1,101}$ = 0.509, p = 0.4770	**$F_{1,101}$ = 5.060, p = 0.0267**	$F_{1,87}$ = 1.494, p = 0.2248	$F_{1,38}$ = 2.764, p = 0.1046
Analysis of deviance				
Experimental replicate	**χ^2_1 = 5.182, p = 0.0228**	χ^2_1 = 0.636, p = 0.4253	χ^2_1 = 0, p = 1	χ^2_1 = 0.081, p = 0.7759
R^2				
Marginal	0.487	0.488	0.363	0.474
Conditional	0.562	0.510	0.371	0.564
iv) Metabolite effect on TAG content				
ANOVA effect test (Type II ANOVA)	***Ethanol***	***Acetic acid***	***Lactic acid***	***Acetoin***
Concentration	$F_{2,98.32}$ = 0.073, p = 0.9293	**$F_{2,99.32}$ = 5.822, p = 0.0041**	$F_{2,85.69}$ = 1.180, p = 0.3122	$F_{2,99.04}$ = 0.775, p = 0.4636
Sex	$F_{1,75.92}$ = 3.606, p = 0.0614	$F_{1,97.97}$ = 3.124, p = 0.0803	$F_{1,85.66}$ = 3.393, p = 0.0689	$F_{1,83.94}$ = 2.617, p = 0.1095
Concentration*Sex	$F_{2,98.02}$ = 0.128, p = 0.8805	$F_{2,98.31}$ = 0.786, p = 0.4587	$F_{2,85.01}$ = 2.976, p = 0.0563	$F_{2,99.04}$ = 0.459, p = 0.6335
Total food consumed	$F_{1,88.47}$ = 0.055, p = 0.8148	$F_{1,91.07}$ = 1.134, p = 0.2897	$F_{1,85.56}$ = 1.844, p = 0.1781	$F_{1,22.59}$ = 1.703, p = 0.2050
Weight fly^{-1}	**$F_{1,91.85}$ = 8.477, p = 0.0045**	**$F_{198.79}$ = 49.98, p = 2.2 x 10^{-10}**	**$F_{1,85.43}$ = 41.40, p = 7.0 x 10^{-9}**	**$F_{1, 99.90}$ = 33.19, p = 9.3 x 10^{-8}**
Analysis of deviance				
Experimental replicate	χ^2_1 = 0.089, p = 0.765	χ^2_1 = 0, p = 1	**χ^2_1 = 15.017, p = 0.0001**	χ^2_1 = 0.043, p = 0.8353
R^2				
Marginal	0.320	0.436	0.350	0.341
Conditional	0.338	0.441	0.524	0.426
v) Metabolite effect on glucose content				
ANOVA effect test (Type II ANOVA)	***Ethanol***	***Acetic acid***	***Lactic acid***	***Acetoin***
Concentration	$F_{2,98.09}$ = 0.759, p = 0.4709	$F_{2,98.95}$ = 0.628, p = 0.5359	$F_{2,84.01}$ = 3.784, p = 0.0267	$F_{2,98.57}$ = 0.994, p = 0.3739
Sex	**$F_{1,99}$ = 42.031, p = 3.5 x 10^{-9}**	**$F_{1,100}$ = 28.913, p = 5.0 x 10^{-7}**	**$F_{1,83.9}$ = 32.465, p = 1.8 x 10^{-7}**	**$F_{1,98.6}$ = 15.587, p = 0.0001**
Concentration*Sex	$F_{2,98.00}$ = 2.178, p = 0.1188	$F_{2,98.16}$ = 0.024, p = 0.9760	$F_{2,85.13}$ = 0.872, p = 0.4218	**$F_{2,98.57}$ = 4.831, p = 0.0100**
Total food consumed	**$F_{1,100}$ = 4.219, p = 0.0426**	**$F_{1,99}$ = 11.685, p = 0.0009**	$F_{1,85.25}$ = 2.894, p = 0.0926	$F_{1,69.81}$ = 2.483, p = 0.1196
Weight fly^{-1}	$F_{1,99.94}$ = 3.501, p = 0.0643	**$F_{1,99.97}$ = 5.213, p = 0.0245**	**$F_{1,86.67}$ = 5.572, p = 0.0205**	**$F_{1,99.6}$ = 44.592, p = 1.4 x 10^{-9}**
Analysis of deviance				
Experimental replicate	**χ^2_1 = 7.610, p = 0.0058**	χ^2_1 = 0.556, p = 0.4558	χ^2_1 = 0, p = 1	**χ^2_1 = 12.286, p = 0.0005**
R^2				
Marginal	0.535	0.476	0.576	0.575
Conditional	0.612	0.499	0.576	0.708
vi) Metabolite effect on protein content				
ANOVA effect test (Type II ANOVA)	***Ethanol***	***Acetic acid***	***Lactic acid***	***Acetoin***

Concentration	$F_{2,98.09}$ = 2.223, p = 0.1137	**$F_{2,99.29}$ = 7.939, p = 0.0006**	$F_{2,85.5}$ = 2.874, p = 0.0619	$F_{2,99.44}$ = 0.763, p = 0.4690
Sex	**$F_{1,99.8}$ = 38.28, p = 1.4 x 10^{-8}**	**$F_{1,95.1}$ = 60.998, p = 7.5 x 10^{-12}**	**$F_{1,86}$ = 35.555, p = 5.3 x 10^{-8}**	$F_{1,54.03}$ = 3.839, p = 0.0553
Concentration*Sex	$F_{2,98.00}$ = 1.184, p = 0.3103	$F_{2,98.40}$ = 0.295, p = 0.7452	**$F_{2,85.09}$ = 5.598, p = 0.0052**	$F_{2,99.43}$ = 0.795, p = 0.4545
Total food consumed	$F_{1,100}$ = 3.117, p = 0.0805	$F_{1,83.09}$ = 0.085, p = 0.7714	$F_{1,86.60}$ = 1.804, p = 0.1826	$F_{1,2.67}$ = 0.500, p = 0.5362
Weight fly^{-1}	$F_{1,100}$ = 0.273, p = 0.6023	**$F_{1,96.5}$ = 38.171, p = 1.5 x 10^{-8}**	**$F_{1,87}$ = 87.384, p = 8.7 x 10^{-15}**	$F_{1,98.43}$ = 0.169, p = 0.6821
Analysis of deviance				
Experimental replicate	**χ^2_1 = 6.976, p = 0.00826**	χ^2_1 = 0, p = 1	χ^2_1 = 0, p = 1	χ^2_1 = 0, p = 1
R^2				
Marginal	0.633	0.814	0.799	0.105
Conditional	0.693	0.814	0.802	0.106

P-values below the threshold are bolded.

Table S1G. Effect of microbiota member presence on SCFA content

Analysis categories	Acetic acid	Propionic acid	Butyric acid	Total
Tukey test				
Axenic-F	AB	AB	AB	AB
Axenic-M	a	a	b	a
ACE-F	B	B	B	B
ACE-M	a	a	b	a
LAC-F	AB	AB	AB	AB
LAC-M	a	a	b	a
YST-F	AB	A	A	A
YST-M	a	a	a	a
ACE+LAC-F	AB	AB	AB	AB
ACE+LAC-M	a	a	b	a
ACE+YST-F	A	AB	B	AB
ACE+YST-M	a	a	ab	a
LAC+YST-F	AB	AB	AB	AB
LAC+YST-M	a	a	ab	a
ACE+LAC+YST-F	AB	AB	AB	AB
ACE+LAC+YST-M	a	a	ab	a
ANOVA Effect test				
sex	$F_{1,39.34}$ = 0.0025, p = 0.9607, ω^2 = - 0.015	$F_{1,39.33}$ = 0.0881, p = 0.7681, ω^2 = -0.012	$F_{1,39.35}$ = 0.0635, p = 0.8023, ω^2 = -0.011	$F_{1,39.29}$ = 0.0704, p = 0.7921, ω^2 = -0.013
ACE	$F_{1,37.91}$ = 0.3776, p = 0.5424, ω^2 = - 0.010	$F_{1,39.91}$ = 0.1708, p = 0.6816, ω^2 = -0.011	*$F_{1,39.90}$ = 3.1695, p = 0.0826, ω^2 = 0.025*	$F_{1,39.93}$ = 0.0010, p= 0.9747, ω^2 = -0.014
LAC	$F_{1,37.91}$ = 0.8531, p = 0.3612, ω^2 = - 0.003	$F_{1,39.91}$ = 1.0488, p = 0.3120, ω^2 = 4.5e-06	$F_{1,39.90}$ = 0.6764, p = 0.4157, ω^2 = -0.004	$F_{1,39.93}$ = 1.1419, p= 0.2917, ω^2 = 0.001
YST	***$F_{1,37.91}$ = 9.1564, p = 0.0043, ω^2 = 0.125***	***$F_{1,39.91}$ = 8.3138, p = 0.0063, ω^2 = 0.093***	***$F_{1,39.90}$ = 18.024, p = 0.0001, ω^2 = 0.197***	***$F_{1,39.93}$ = 10.511, p= 0.0024, ω^2 = 0.136***
ACE*sex	$F_{1,39.38}$ = 1.5957, p = 0.2139, ω^2 = 0.008	***$F_{1,39.37}$ = 14.659, p = 0.0005, ω^2 = 0.178***	$F_{1,39.40}$ = 1.5576, p = 0.2194, ω^2 = 0.007	***$F_{1,39.32}$ = 6.9104, p= 0.0122, ω^2 = 0.085***
LAC*sex	$F_{1,39.38}$ = 0.0064, p = 0.9365, ω^2 = - 0.015	$F_{1,39.37}$ = 0.0027, p = 0.9590, ω^2 = -0.013	*$F_{1,39.40}$ = 2.0504, p = 0.1601, ω^2 = 0.012*	$F_{1,39.32}$ = 0.0068, p= 0.9345, ω^2 = -0.014
YST*sex	$F_{1,39.38}$ = 1.3405, p = 0.2539, ω^2 = 0.004	$F_{1,39.37}$ = 1.3654, p = 0.2496, ω^2 = 0.005	***$F_{1,39.40}$ = 7.9497, p = 0.0075, ω^2 = 0.082***	$F_{1,39.32}$ = 0.0125, p= 0.9117, ω^2 = -0.014
ACE*LAC	*$F_{1,39.92}$ = 1.9286, p = 0.1726, ω^2 = 0.014*	***$F_{1,39.93}$ = 5.7471, p = 0.0213, ω^2 = 0.062***	$F_{1,39.92}$ = 0.8445, p = 0.3636, ω^2 = -0.002	*$F_{1,39.94}$ = 3.7050, p= 0.0614, ω^2 = 0.039*
ACE*YST	*$F_{1,39.92}$ = 3.2895, p = 0.0772, ω^2 = 0.035*	$F_{1,39.93}$ = 0.1624, p = 0.6891, ω^2 = -0.011	$F_{1,39.92}$ = 1.8160, p = 0.1854, ω^2 = 0.009	$F_{1,37.95}$ = 1.1702, p= 0.2858, ω^2 = 0.003
LAC*YST	$F_{1,39.92}$ = 1.0515, p = 0.3113, ω^2 = 0.001	*$F_{1,39.93}$ = 2.8748, p = 0.0978, ω^2 = 0.024*	$F_{1,39.92}$ = 1.7766, p = 0.1901 , ω^2 = 0.009	*$F_{1,39.94}$ = 2.6080, p= 0.1142, ω^2 = 0.023*
ACE*LAC*sex	$F_{1,39.40}$ = 0.1534,	$F_{1,39.40}$ = 1.3125,	***$F_{1,39.42}$ = 4.2188,***	$F_{1,39.35}$ = 0.0017,

	p = 0.6975, ω^2 = - 0.013	p = 0.2589, ω^2 = 0.004	***p = 0.0467, ω^2 = 0.038***	p= 0.9671, ω^2 = -0.014
ACE*YST*sex	$F_{1,39.40}$ = 0.4364, p = 0.5127, ω^2 = - 0.008	$F_{1,39.40}$ = 0.0809, p = 0.7776, ω^2 = -0.012	$F_{1,39.42}$ = 0.5096, p = 0.4795, ω^2 = -0.006	$F_{1,39.35}$ = 0.1985, p= 0.6584, ω^2 = -0.011
LAC*YST*sex	$F_{1,39.40}$ = 0.3572, p = 0.5535, ω^2 = - 0.010	$F_{1,39.40}$ = 0.4912, p = 0.4875, ω^2 = -0.007	$F_{1,39.42}$ = 0.0219, p = 0.8830, ω^2 = -0.012	$F_{1,39.35}$ = 0.4627, p= 0.5004, ω^2 = -0.008
ACE*LAC*YST	$F_{1,39.93}$ = 0.4910, p = 0.4875, ω^2 = - 0.008	$F_{1,39.93}$ = 0.0063, p = 0.9370, ω^2 = -0.013	$F_{1,39.93}$ = 1.5815, p = 0.2158, ω^2 = 0.007	$F_{1,39.95}$ = 0.0252, p= 0.8746, ω^2 = -0.014
ACE*LAC*YST*sex	*$F_{1,39.42}$ = 3.6614, p = 0.0630, ω^2 = 0.041*	$F_{1,39.41}$ = 0.1656, p = 0.6863, ω^2 = -0.011	$F_{1,39.44}$ = 0.1699, p = 0.6824, ω^2 = -0.010	*$F_{1,39.36}$ = 2.0081, p= 0.1643, ω^2 = 0.015*
Analysis of Deviance				
Vial replicate	**X^2_1 = 14.40, p = 0.0001**	**X^2_1 = 13.20, p = 0.0003**	**X^2_1 = 12.88, p = 0.0003**	**X^2_1 = 19.23, p = 1.16 x 10^{-5}**
R^2				
Marginal	0.244	0.274	0.341	0.262
Conditional	0.586	0.649	0.662	0.695

The *post hoc* Tukey test was implemented to assess differences in SCFA content between treatments for each sex. Uppercase letters are used to represent the ranking of female samples and lowercase letters are used to distinguish the rankings for male samples. Significant p-values were bolded and influential effect sizes were italicized. P-values below the threshold are bolded.

Table S1H. Moderation effect of individual SCFA content and microbiota members on individual nutritional indices

i) TAG ~ Acetate		
ANOVA Effect test	***Female***	***Male***
ACE	$F_{1,29.11}$ = 7.954, p = 0.0086	**$F_{1,30.06}$ = 55.596, p = 2.6 x 10^{-8}**
LAC	$F_{1,29.02}$ = 0.166, p = 0.6864	$F_{1,30.01}$ = 0.225, p = 0.6390
YST	$F_{1,29.22}$ = 4.527, p = 0.0419	**$F_{1,30.16}$ = 602.769, p < 2.2 x 10^{-16}**
[Acetate]	$F_{1,30.22}$ = 0.455, p = 0.5049	$F_{1,31.80}$ = 1.755, p = 0.1948
ACE*[Acetate]	$F_{1,29.16}$ = 0.647, p = 0.4276	**$F_{1,30.01}$ = 23.248, p = 3.9 x 10^{-5}**
LAC*[Acetate]	$F_{1,29.36}$ = 1.212, p = 0.2798	$F_{1,31.12}$ = 0.170, p = 0.6831
YST*[Acetate]	$F_{1,29.22}$ = 0.271, p = 0.6064	$F_{1,30.28}$ = 0.416, p = 0.5240
ACE*LAC	$F_{1,29.03}$ = 0.146, p = 0.7048	**$F_{1,30.06}$ = 12.789, p = 0.0012**
ACE*YST	$F_{1,29.27}$ = 0.055, p = 0.8166	**$F_{1,30.09}$ = 23.741, p = 3.3 x 10^{-5}**
LAC*YST	$F_{1,29.07}$ = 1.623, p = 0.2127	**$F_{1,30.42}$ = 21.530, p = 6.2 x 10^{-5}**
ACE*LAC*[Acetate]	$F_{1,29.00}$ = 0.580, p = 0.4524	$F_{1,30.86}$ = 4.630, p = 0.0394
ACE*YST*[Acetate]	$F_{1,29.53}$ = 0.080, p = 0.7797	**$F_{1,31.03}$ = 17.940, p = 0.0002**
LAC*YST*[Acetate]	$F_{1,29.41}$ = 0.914, p = 0.3468	$F_{1,30.10}$ = 1.793, p = 0.1906
ACE*LAC*YST	$F_{1,29.06}$ = 0.727, p = 0.4010	$F_{1,30.28}$ = 4.781, p = 0.0366
ACE*LAC*YST*[Acetate]	$F_{1,29.56}$ = 2.103, p = 0.1576	$F_{1,30.33}$ = 0.691, p = 0.4125
Analysis of Deviance		
Experimental replicate	**X^2_1 = 11.45, p = 0.0007**	**X^2_1 = 5.73, p = 0.0167**
R^2		
Marginal	0.233	0.929
Conditional	0.532	0.946
ii) Glucose ~ Acetate		
ANOVA Effect test	***Female (ln-transformed)***	***Male (ln-transformed)***
ACE	$F_{1,29.42}$ = 2.988, p = 0.0944	$F_{1,30.20}$ = 2.148, p = 0.1531
LAC	$F_{1,29.08}$ = 2.958, p = 0.0961	$F_{1,30.04}$ = 5.118, p = 0.0311
YST	**$F_{1,29.75}$ = 69.513, p = 2.8 x 10^{-9}**	**$F_{1,30.47}$ = 169.154, p = 5.7 x 10^{-14}**
[Acetate]	$F_{1,30.63}$ = 0.792, p = 0.3803	$F_{1,28.74}$ = 1.078, p = 0.3079
ACE*[Acetate]	$F_{1,29.83}$ = 1.189, p = 0.2844	$F_{1,30.06}$ = 0.018, p = 0.8938
LAC*[Acetate]	$F_{1,30.24}$ = 0.445, p = 0.5099	$F_{1,31.89}$ = 3.185, p = 0.0839
YST*[Acetate]	$F_{1,30.06}$ = 0.033, p = 0.8572	$F_{1,30.75}$ = 1.929, p = 0.1748
ACE*LAC	$F_{1,29.19}$ = 2.767, p = 0.1069	$F_{1,30.23}$ = 2.611, p = 0.1165
ACE*YST	$F_{1,30.02}$ = 11.299, p = 0.0021	$F_{1,30.31}$ = 4.688, p = 0.0384
LAC*YST	$F_{1,29.38}$ = 0.859, p = 0.3617	$F_{1,31.18}$ = 1.460, p = 0.2361
ACE*LAC*[Acetate]	$F_{1,29.04}$ = 1.613, p = 0.2142	$F_{1,31.90}$ = 0.027, p = 0.8707
ACE*YST*[Acetate]	$F_{1,30.62}$ = 0.487, p = 0.4907	$F_{1,32.00}$ = 1.281, p = 0.2661
LAC*YST*[Acetate]	$F_{1,30.59}$ = 0.452, p = 0.5062	$F_{1,30.32}$ = 0.012, p = 0.9141
ACE*LAC*YST	$F_{1,29.28}$ = 0.135, p = 0.7161	$F_{1,30.83}$ = 1.206, p = 0.2806
ACE*LAC*YST*[Acetate]	$F_{1,30.78}$ = 2.505, p = 0.1237	$F_{1,30.93}$ = 1.241, p = 0.2739
Analysis of Deviance		
Experimental replicate	X^2_1 = 0.034, p = 0.854	**X^2_1 = 35.47, p = 2.6 x 10^{-9}**
R^2		
Marginal	0.684	0.814
Conditional	0.703	0.819

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iii) Protein ~ Acetate		
ANOVA Effect test	***Female***	***Male***
ACE	$F_{1,29.65}$ = 0.191, p = 0.6650	$F_{1,30.27}$ = 1.102, p = 0.3021
LAC	$F_{1,29.16}$ = 0.003, p = 0.9564	$F_{1,30.07}$ = 0.183, p = 0.6722
YST	$F_{1,30.08}$ = 8.476, p = 0.0067	$F_{1,30.61}$ = 2.782, p = 0.1055
[Acetate]	$F_{1,27.86}$ = 1.729, p = 0.1992	$F_{1,24.45}$ = 0.202, p = 0.6572
ACE*[Acetate]	$F_{1,30.43}$ = 0.831, p = 0.3691	$F_{1,30.09}$ = 0.378, p = 0.5434
LAC*[Acetate]	$F_{1,30.68}$ = 0.772, p = 0.3864	$F_{1,30.96}$ = 0.001, p = 0.9784
YST*[Acetate]	$F_{1,30.65}$ = 3.378, p = 0.0758	$F_{1,30.92}$ = 0.137, p = 0.7135
ACE*LAC	$F_{1,29.37}$ = 0.206, p = 0.6537	$F_{1,30.33}$ = 1.088, p = 0.3053
ACE*YST	$F_{1,30.51}$ = 1.043, p = 0.3153	$F_{1,30.43}$ = 1.471, p = 0.2345
LAC*YST	$F_{1,29.69}$ = 0.768, p = 0.3880	$F_{1,31.44}$ = 0.229, p = 0.6353
ACE*LAC*[Acetate]	$F_{1,29.10}$ = 0.530, p = 0.4723	$F_{1,32.00}$ = 1.453, p = 0.2368
ACE*YST*[Acetate]	$F_{1,30.96}$ = 1.741, p = 0.1967	$F_{1,31.69}$ = 0.113, p = 0.7395
LAC*YST*[Acetate]	$F_{1,31.00}$ = 0.903, p = 0.3495	$F_{1,30.41}$ = 0.052, p = 0.8218
ACE*LAC*YST	$F_{1,29.47}$ = 0.040, p = 0.8429	$F_{1,31.04}$ = 0.225, p = 0.6384
ACE*LAC*YST*[Acetate]	$F_{1,30.99}$ = 0.374, p = 0.5452	$F_{1,31.13}$ = 0.924, p = 0.3440
Analysis of Deviance		
Experimental replicate	X^2_1 = 0, p = 1	X^2_1 = 0, p = 1
R²		
Marginal	0.346	0.201
Conditional	0.346	0.201
iv) Glycogen ~ Acetate		
ANOVA Effect test	***Female***	***Male***
ACE	$F_{1,29.65}$ = 2.034, p = 0.1643	$F_{1,30.06}$ = 5.552, p = 0.0252
LAC	$F_{1,29.16}$ = 1.837, p = 0.1857	$F_{1,30.01}$ = 0.206, p = 0.6533
YST	**$F_{1,30.08}$ = 13.687, p = 0.0009**	$F_{1,30.18}$ = 1.836, p = 0.1855
[Acetate]	$F_{1,27.86}$ = 0.483, p = 0.4929	$F_{1,31.88}$ = 0.374, p = 0.5454
ACE*[Acetate]	$F_{1,30.43}$ = 0.191, p = 0.6650	$F_{1,30.02}$ = 0.212, p = 0.6488
LAC*[Acetate]	$F_{1,30.68}$ = 0.252, p = 0.6194	$F_{1,31.21}$ = 2.913, p = 0.0978
YST*[Acetate]	$F_{1,30.65}$ = 0.339, p = 0.5645	$F_{1, 30.31}$ = 0.014, p = 0.9053
ACE*LAC	$F_{1,29.37}$ = 0.192, p = 0.6647	$F_{1,30.07}$ = 1.364, p = 0.2520
ACE*YST	$F_{1,30.51}$ = 3.616, p = 0.0667	$F_{1,30.10}$ = 1.797, p = 0.1901
LAC*YST	$F_{1,29.69}$ = 2.921, p = 0.0978	$F_{1,30.46}$ = 2.026, p = 0.1648
ACE*LAC*[Acetate]	$F_{1,29.10}$ = 0.199, p = 0.6586	$F_{1,30.94}$ = 0.167, p = 0.6859
ACE*YST*[Acetate]	$F_{1,30.96}$ = 0.447, p = 0.5089	$F_{1, 31.12}$ = 0.364, p = 0.5508
LAC*YST*[Acetate]	$F_{1,31.00}$ = 1.343, p = 0.2553	$F_{1,30.11}$ = 0.716, p = 0.4040
ACE*LAC*YST	$F_{1,29.47}$ = 0.001, p = 0.9824	$F_{1,30.31}$ = 0.613, p = 0.4398
ACE*LAC*YST*[Acetate]	$F_{1,30.99}$ = 0.691, p = 0.4121	$F_{1,30.36}$ = 2.029, p = 0.1645
Analysis of Deviance		
Experimental replicate	X^2_1 = 0, p = 1	**X^2_1 = 3.96 p = 0.0466**
R²		
Marginal	0.446	0.281
Conditional	0.446	0.430

v) Trehalose ~ Acetate		
ANOVA Effect test	***Female (ln-transformed)***	***Male (ln-transformed)***
ACE	$F_{1,29.39} = 0.816, p = 0.3738$	$F_{1,30.27} = 0.040, p = 0.8436$
LAC	$F_{1,29.08} = 1.384, p = 0.2489$	$F_{1,30.07} = 0.194, p = 0.6632$
YST	$\mathbf{F_{1,29.72} = 25.518, p = 2.1 \times 10^{-5}}$	$\mathbf{F_{1,30.61} = 14.018, p = 0.0008}$
[Acetate]	$F_{1,30.75} = 9.706, p = 0.0040$	$F_{1,24.45} = 0.255, p = 0.6183$
ACE*[Acetate]	$F_{1,29.77} = 7.690, p = 0.0095$	$F_{1,30.09} = 0.316, p = 0.5784$
LAC*[Acetate]	$F_{1,30.19} = 9.719, p = 0.0040$	$F_{1,30.96} = 0.152, p = 0.6990$
YST*[Acetate]	$F_{1,29.99} = 0.499, p = 0.4854$	$F_{1,30.92} = 0.065, p = 0.8006$
ACE*LAC	$F_{1,29.17} = 3.069, p = 0.0903$	$F_{1,30.33} = 1.165, p = 0.2890$
ACE*YST	$F_{1,29.97} = 6.471, p = 0.0164$	$F_{1,30.43} = 0.599, p = 0.4450$
LAC*YST	$F_{1,29.35} = 1.799, p = 0.1902$	$F_{1,31.44} = 7.366, p = 0.0107$
ACE*LAC*[Acetate]	$F_{1,29.04} = 2.895, p = 0.0995$	$F_{1,32.00} = 0.356, p = 0.5551$
ACE*YST*[Acetate]	$F_{1,30.57} = 1.088, p = 0.3051$	$F_{1,31.69} = 0.092, p = 0.7635$
LAC*YST*[Acetate]	$F_{1,30.52} = 0.407, p = 0.5285$	$F_{1,30.41} = 0.107, p = 0.7456$
ACE*LAC*YST	$F_{1, 29.26} = 0.129, p = 0.7219$	$F_{1,31.04} = 0.442, p = 0.5110$
ACE*LAC*YST*[Acetate]	$F_{1,30.72} = 0.005, p = 0.9420$	$F_{1,31.13} = 1.733, p = 0.1977$
Analysis of Deviance		
Experimental replicate	$X^2_1 = 0.25$, $p = 0.6163$	$X^2_1 = 0$, $p = 1$
R^2		
Marginal	0.585	0.394
Conditional	0.614	0.394
vi) TAG ~ Propionate		
ANOVA Effect test	***Female***	***Male (sqrt-transformed)***
ACE	$F_{1,29.03} = 6.032, p = 0.0203$	$\mathbf{F_{1,30.06} = 30.458, p = 5.3 \times 10^{-6}}$
LAC	$F_{1,29.11} = 0.060, p = 0.8077$	$F_{1,30.02} = 3.124, p = 0.0873$
YST	$F_{1,29.10} = 2.672, p = 0.1129$	$\mathbf{F_{1,30.26} = 397.131, p > 2.2 \times 10^{-16}}$
[Propionate]	$F_{1,30.25} = 1.034, p = 0.3173$	$F_{1,31.33} = 0.054, p = 0.8172$
ACE*[Propionate]	$F_{1,29.46} = 0.599, p = 0.4451$	$F_{1,30.26} = 7.695, p = 0.0094$
LAC*[Propionate]	$F_{1,29.27} = 0.001, p = 0.9716$	$F_{1,30.75} = 0.010, p = 0.9207$
YST*[Propionate]	$F_{1,29.81} = 0.536, p = 0.4699$	$F_{1,31.17} = 1.032, p = 0.3174$
ACE*LAC	$F_{1,29.16} = 0.0002, p = 0.9877$	$F_{1,30.02} = 7.213, p = 0.0117$
ACE*YST	$F_{1,29.28} = 0.775, p = 0.3857$	$F_{1,30.13} = 3.546, p = 0.0694$
LAC*YST	$F_{1,29.03} = 1.431, p = 0.2413$	$F_{1,30.26} = 11.174, p = 0.0022$
ACE*LAC*[Propionate]	$F_{1,29.79} = 1.349, p = 0.2548$	$F_{1,30.70} = 3.355, p = 0.0767$
ACE*YST*[Propionate]	$F_{1,29.46} = 0.033, p = 0.8582$	$F_{1,30.97} = 1.043, p = 0.3151$
LAC*YST*[Propionate]	$F_{1,30.63} = 0.551, p = 0.4637$	$F_{1,31.32} = 0.037, p = 0.8484$
ACE*LAC*YST	$F_{1,29.34} = 0.514, p = 0.4790$	$F_{1,30.40} = 1.043, p = 0.3153$
ACE*LAC*YST*[Propionate]	$F_{1,29.28} = 0.040, p = 0.8425$	$F_{1,30.06} = 0.104, p = 0.7495$
Analysis of Deviance		
Experimental replicate	$\mathbf{X^2_1 = 5.47}$, $\mathbf{p = 0.0193}$	$\mathbf{X^2_1 = 6.20}$, $\mathbf{p = 0.0128}$
R^2		
Marginal	0.244	0.898
Conditional	0.429	0.924

vii) Glucose ~ Propionate		
ANOVA Effect test	***Female***	***Male (sqrt-transformed)***
ACE	$F_{1,29.16} = 0.135, p = 0.7159$	$F_{1,30.08} = 0.648, p = 0.4273$
LAC	$F_{1,29.36} = 4.994, p = 0.0332$	$F_{1,30.03} = 8.688, p = 0.0061$
YST	$\mathbf{F_{1,29.44} = 43.147, p = 3.1 \times 10^{-7}}$	$\mathbf{F_{1,30.35} = 137.028, p = 8.8 \times 10^{-13}}$
[Propionate]	$F_{1,29.74} = 1.852, p = 0.1837$	$F_{1,31.65} = 0.813, p = 0.3741$
ACE*[Propionate]	$F_{1,30.79} = 0.002, p = 0.9679$	$F_{1,30.35} = 0.017, p = 0.8968$
LAC*[Propionate]	$F_{1, 30.04} = 0.816, p = 0.3734$	$F_{1,31.00} = 0.414, p = 0.5249$
YST*[Propionate]	$F_{1,30.98} = 2.409, p = 0.1308$	$F_{1,31.51} = 1.167, p = 0.2882$
ACE*LAC	$F_{1,29.56} = 4.224, p = 0.0488$	$F_{1,30.03} = 1.327, p = 0.2585$
ACE*YST	$F_{1,30.18} = 11.623, p = 0.0019$	$F_{1,30.18} = 2.251, p = 0.1439$
LAC*YST	$F_{1,29.11} = 2.322, p = 0.1384$	$F_{1,30.35} = 4.411, p = 0.0441$
ACE*LAC*[Propionate]	$F_{1,31.00} = 0.366, p = 0.5497$	$F_{1,30.93} = 0.210, p = 0.6499$
ACE*YST*[Propionate]	$F_{1,30.53} = 2.592, p = 0.1177$	$F_{1,31.29} = 0.063, p = 0.8035$
LAC*YST*[Propionate]	$F_{1,26.25} = 1.055, p = 0.3137$	$F_{1,31.69} = 0.000, p = 0.9971$
ACE*LAC*YST	$F_{1,30.34} = 0.417, p = 0.5235$	$F_{1,30.55} = 0.109, p = 0.7435$
ACE*LAC*YST*[Propionate]	$F_{1,30.34} = 1.193, p = 0.2833$	$F_{1,30.09} = 0.017, p = 0.8983$
Analysis of Deviance		
Experimental replicate	$X^2_1 = 0$, $p = 1$	$X^2_1 = 3.00$, $p = 0.0834$
R^2		
Marginal	0.628	0.768
Conditional	0.628	0.810
viii) Protein ~ Propionate		
ANOVA Effect test	***Female***	***Male***
ACE	$F_{1,29.16} = 0.388, p = 0.5381$	$F_{1,30.26} = 1.475, p = 0.2339$
LAC	$F_{1,29.36} = 0.054, p = 0.8187$	$F_{1,30.09} = 0.203, p = 0.6557$
YST	$\mathbf{F_{1,29.44} = 14.851, p = 0.0006}$	$F_{1,30.95} = 3.981, p = 0.0549$
[Propionate]	$F_{1,29.74} = 0.654, p = 0.4253$	$F_{1,30.65} = 0.270, p = 0.6070$
ACE*[Propionate]	$F_{1,30.79} = 0.817, p = 0.3730$	$F_{1,31.08} = 1.252, p = 0.2718$
LAC*[Propionate]	$F_{1,30.04} = 2.740, p = 0.1083$	$F_{1,32.00} = 0.357, p = 0.5543$
YST*[Propionate]	$F_{1,30.98} = 11.055, p = 0.0023$	$F_{1,30.52} = 0.774, p = 0.3859$
ACE*LAC	$F_{1,29.56} = 0.412, p = 0.5258$	$F_{1,30.15} = 1.138, p = 0.2946$
ACE*YST	$F_{1,30.18} = 2.117, p = 0.1560$	$F_{1,30.61} = 0.471, p = 0.4976$
LAC*YST	$F_{1,29.11} = 1.518, p = 0.2278$	$F_{1,31.03} = 0.101, p = 0.7522$
ACE*LAC*[Propionate]	$F_{1,31.00} = 1.367, p = 0.2513$	$F_{1,32.00} = 2.610, p = 0.1160$
ACE*YST*[Propionate]	$F_{1,30.53} = 5.631, p = 0.0241$	$F_{1,30.68} = 0.788, p = 0.3817$
LAC*YST*[Propionate]	$F_{1,26.25} = 2.470, p = 0.1280$	$F_{1,26.45} = 0.300, p = 0.5887$
ACE*LAC*YST	$F_{1,30.34} = 0.530, p = 0.4720$	$F_{1,31.60} = 0.303, p = 0.5861$
ACE*LAC*YST*[Propionate]	$F_{1,30.34} = 1.519, p = 0.2273$	$F_{1,30.35} = 0.746, p = 0.3945$
Analysis of Deviance		
Experimental replicate	$X^2_1 = 0$, $p = 1$	$X^2_1 = 0$, $p = 1$
R^2		
Marginal	0.457	0.256
Conditional	0.457	0.256

ix) Glycogen ~ Propionate		
ANOVA Effect test	***Female***	***Male***
ACE	$F_{1,29.16} = 3.263, p = 0.0812$	$F_{1,30.05} = 6.715, p = 0.0146$
LAC	$F_{1,29.36} = 1.484, p = 0.2328$	$F_{1,30.02} = 0.217, p = 0.6447$
YST	**$F_{1,29.44} = 18.380, p = 0.0002$**	$F_{1,30.21} = 1.252, p = 0.2721$
[Propionate]	$F_{1,29.74} = 0.284, p = 0.5981$	$F_{1,31.14} = 1.170, p = 0.2877$
ACE*[Propionate]	$F_{1,30.79} = 0.145, p = 0.7062$	$F_{1,30.21} = 0.967, p = 0.3334$
LAC*[Propionate]	$F_{1,30.04} = 0.623, p = 0.4361$	$F_{1,30.62} = 3.203, p = 0.0834$
YST*[Propionate]	$F_{1,30.98} = 1.601, p = 0.2152$	$F_{1,30.98} = 0.071, p = 0.7918$
ACE*LAC	$F_{1,29.56} = 0.571, p = 0.4560$	$F_{1,30.02} = 1.667, p = 0.2065$
ACE*YST	$F_{1,30.18} = 3.613, p = 0.0669$	$F_{1,30.11} = 2.313, p = 0.1388$
LAC*YST	$F_{1,29.11} = 4.109, p = 0.0519$	$F_{1,30.21} = 2.701, p = 0.1107$
ACE*LAC*[Propionate]	$F_{1,31.00} = 0.325, p = 0.5730$	$F_{1,30.57} = 1.426, p = 0.2416$
ACE*YST*[Propionate]	$F_{1,30.53} = 0.340, p = 0.5643$	$F_{1,30.79} = 0.158, p = 0.6941$
LAC*YST*[Propionate]	$F_{1,26.25} = 0.736, p = 0.3989$	$F_{1,31.10} = 0.009, p = 0.9268$
ACE*LAC*YST	$F_{1,30.34} = 0.011, p = 0.9182$	$F_{1,30.33} = 0.189, p = 0.6667$
ACE*LAC*YST*[Propionate]	$F_{1,30.34} = 2.587, p = 0.1181$	$F_{1,30.05} = 1.934, p = 0.1746$
Analysis of Deviance		
Experimental replicate	$X^2_1 = 0$, $p = 1$	**$X^2_1 = 7.56$, $p = 0.0060$**
R^2		
Marginal	0.483	0.279
Conditional	0.483	0.500

x) Trehalose ~ Propionate		
ANOVA Effect test	***Female (ln-transformed)***	***Male (ln-transformed)***
ACE	$F_{1,29.07} = 0.007, p = 0.9320$	$F_{1,30.26} = 0.085, p = 0.7730$
LAC	$F_{1,29.20} = 1.861, p = 0.1829$	$F_{1,30.09} = 0.362, p = 0.5519$
YST	$F_{1,29.20} = 11.328, p = 0.0022$	$F_{1,30.95} = 11.648, p = 0.0018$
[Propionate]	$F_{1,30.93} = 2.714, p = 0.1096$	$F_{1,30.65} = 0.038, p = 0.8464$
ACE*[Propionate]	$F_{1,29.93} = 3.319, p = 0.0785$	$F_{1,31.08} = 0.131, p = 0.7198$
LAC*[Propionate]	$F_{1,29.52} = 0.341, p = 0.5639$	$F_{1,32.00} = 0.075, p = 0.7858$
YST*[Propionate]	$F_{1,30.40} = 2.145, p = 0.1533$	$F_{1,30.52} = 0.009, p = 0.9257$
ACE*LAC	$F_{1,29.30} = 2.671, p = 0.1129$	$F_{1,30.15} = 0.868, p = 0.3589$
ACE*YST	$F_{1,29.58} = 1.745, p = 0.1967$	$F_{1,30.61} = 0.939, p = 0.3401$
LAC*YST	$F_{1,29.05} = 4.912, p = 0.0347$	$F_{1,31.03} = 6.807, p = 0.0139$
ACE*LAC*[Propionate]	$F_{1,30.42} = 1.177, p = 0.2864$	$F_{1,32.00} = 1.260, p = 0.2700$
ACE*YST*[Propionate]	$F_{1,29.88} = 0.032, p = 0.8602$	$F_{1,30.68} = 0.013, p = 0.9117$
LAC*YST*[Propionate]	$F_{1,30.91} = 2.222, p = 0.1462$	$F_{1,26.45} = 0.703, p = 0.4092$
ACE*LAC*YST	$F_{1,29.68} = 0.838, p = 0.3674$	$F_{1,31.60} = 1.205, p = 0.2806$
ACE*LAC*YST*[Propionate]	$F_{1,29.60} = 0.007, p = 0.9363$	$F_{1,30.35} = 0.000, p = 0.9897$
Analysis of Deviance		
Experimental replicate	$X^2_1 = 0.61$, $p = 0.4345$	$X^2_1 = 0$, $p = 1$
R^2		
Marginal	0.429	0.399
Conditional	0.485	0.399

xi) TAG ~ Butyrate		
ANOVA Effect test	***Female***	***Male***
ACE	$F_{1,29.02} = 11.610$, $p = 0.0019$	**$F_{1,30.02} = 28.194$, $p = 9.7 \times 10^{-6}$**
LAC	$F_{1,29.03} = 0.091$, $p = 0.7650$	$F_{1,31.05} = 0.468$, $p = 0.4990$
YST	$F_{1,29.05} = 7.143$, $p = 0.0122$	**$F_{1,31.72} = 168.330$, $p = 3.1 \times 10^{-14}$**
[Butyrate]	$F_{1,29.98} = 1.113$, $p = 0.2999$	$F_{1,29.95} = 0.066$, $p = 0.7994$
ACE*[Butyrate]	$F_{1,29.12} = 1.895$, $p = 0.1792$	$F_{1,30.04} = 0.435$, $p = 0.5146$
LAC*[Butyrate]	$F_{1,29.01} = 0.155$, $p = 0.6965$	$F_{1,30.33} = 0.032$, $p = 0.8584$
YST*[Butyrate]	$F_{1,29.16} = 0.912$, $p = 0.3476$	$F_{1,31.04} = 1.134$, $p = 0.2951$
ACE*LAC	$F_{1,29.08} = 0.182$, $p = 0.6727$	$F_{1,30.23} = 4.330$, $p = 0.0460$
ACE*YST	$F_{1,29.01} = 1.257$, $p = 0.2714$	$F_{1,30.06} = 9.371$, $p = 0.0046$
LAC*YST	$F_{1,29.01} = 0.030$, $p = 0.8637$	$F_{1,30.08} = 2.292$, $p = 0.1405$
ACE*LAC*[Butyrate]	$F_{1,30.25} = 0.472$, $p = 0.4973$	$F_{1,31.78} = 1.770$, $p = 0.1929$
ACE*YST*[Butyrate]	$F_{1,29.02} = 6.957$, $p = 0.0133$	$F_{1,31.32} = 0.867$, $p = 0.3588$
LAC*YST*[Butyrate]	$F_{1,29.14} = 1.651$, $p = 0.2090$	$F_{1,30.51} = 2.824$, $p = 0.1031$
ACE*LAC*YST	$F_{1,29.16} = 0.004$, $p = 0.9500$	$F_{1,31.97} = 5.565$, $p = 0.0246$
ACE*LAC*YST*[Butyrate]	$F_{1, 29.15} = 0.236$, $p = 0.6305$	$F_{1,31.41} = 0.186$, $p = 0.6695$
Analysis of Deviance		
Experimental replicate	**$X^2_1 = 12.84$, $p = 0.0003$**	$X^2_1 = 0$, $p = 0.7386$
R^2		
Marginal	0.281	0.879
Conditional	0.590	0.887
xii) Glucose ~ Butyrate		
ANOVA Effect test	***Female***	***Male***
ACE	$F_{1,29.06} = 0.112$, $p = 0.7404$	$F_{1,30.01} = 0.200$, $p = 0.6581$
LAC	$F_{1,29.09} = 2.510$, $p = 0.1239$	$F_{1,30.73} = 10.487$, $p = 0.0029$
YST	**$F_{1,29.16} = 41.598$, $p = 4.6 \times 10^{-7}$**	**$F_{1,31.34} = 67.071$, $p = 2.8 \times 10^{-9}$**
[Butyrate]	$F_{1,30.99} = 0.186$, $p = 0.6690$	$F_{1,31.76} = 0.992$, $p = 0.3268$
ACE*[Butyrate]	$F_{1,29.42} = 0.709$, $p = 0.4065$	$F_{1,30.02} = 1.355$, $p = 0.2536$
LAC*[Butyrate]	$F_{1,29.05} = 1.072$, $p = 0.3090$	$F_{1,30.22} = 0.793$, $p = 0.3804$
YST*[Butyrate]	$F_{1,29.52} = 1.912$, $p = 0.1772$	$F_{1,31.99} = 3.458$, $p = 0.0722$
ACE*LAC	$F_{1,29.29} = 1.056$, $p = 0.3126$	$F_{1,30.16} = 0.001$, $p = 0.9718$
ACE*YST	$F_{1,29.04} = 10.692$, $p = 0.0028$	$F_{1,30.04} = 1.670$, $p = 0.2061$
LAC*YST	$F_{1,29.04} = 0.479$, $p = 0.4944$	$F_{1,30.05} = 1.884$, $p = 0.1800$
ACE*LAC*[Butyrate]	$F_{1,30.38} = 1.820$, $p = 0.1873$	$F_{1,31.94} = 0.248$, $p = 0.6222$
ACE*YST*[Butyrate]	$F_{1,29.08} = 0.000$, $p = 0.9997$	$F_{1,30.92} = 2.975$, $p = 0.0945$
LAC*YST*[Butyrate]	$F_{1,29.49} = 0.443$, $p = 0.5108$	$F_{1,30.35} = 2.719$, $p = 0.1095$
ACE*LAC*YST	$F_{1,29.54} = 0.016$, $p = 0.8997$	$F_{1,31.83} = 0.004$, $p = 0.9522$
ACE*LAC*YST*[Butyrate]	$F_{1,29.51} = 0.307$, $p = 0.5839$	$F_{1,30.94} = 0.466$, $p = 0.5000$
Analysis of Deviance		
Experimental replicate	$X^2_1 = 1.49$, $p = 0.2217$	$X^2_1 = 1.67$, $p = 0.1965$
R^2		
Marginal	0.612	0.759
Conditional	0.661	0.793

xiii) Protein ~ Butyrate		
ANOVA Effect test	***Female***	***Male***
ACE	$F_{1,29.16}$ = 0.140, p = 0.7111	$F_{1,30.06}$ = 0.098, p = 0.7563
LAC	$F_{1,29.23}$ = 0.001, p = 0.9729	$F_{1,31.53}$ = 0.360, p = 0.5527
YST	$F_{1,29.38}$ = 11.624, p = 0.0019	$F_{1,32.00}$ = 0.328, p = 0.5706
[Butyrate]	$F_{1,24.74}$ = 0.723, p = 0.4035	$F_{1,22.88}$ = 2.488, p = 0.1285
ACE*[Butyrate]	$F_{1,30.03}$ = 0.006, p = 0.9371	$F_{1,30.08}$ = 0.751, p = 0.3931
LAC*[Butyrate]	$F_{1,29.12}$ = 0.610, p = 0.4413	$F_{1,30.52}$ = 1.053, p = 0.3129
YST*[Butyrate]	$F_{1,30.17}$ = 2.140, p = 0.1539	$F_{1,25.48}$ = 0.895, p = 0.3531
ACE*LAC	$F_{1,29.73}$ = 0.017, p = 0.8960	$F_{1,30.36}$ = 0.618, p = 0.4378
ACE*YST	$F_{1,29.10}$ = 0.198, p = 0.6596	$F_{1,30.12}$ = 1.896, p = 0.1787
LAC*YST	$F_{1,29.12}$ = 0.609, p = 0.4416	$F_{1,30.16}$ = 0.279, p = 0.6012
ACE*LAC*[Butyrate]	$F_{1,14.72}$ = 0.616, p = 0.4450	$F_{1,28.35}$ = 0.029, p = 0.8669
ACE*YST*[Butyrate]	$F_{1,29.22}$ = 0.745, p = 0.3952	$F_{1,31.85}$ = 0.003, p = 0.9545
LAC*YST*[Butyrate]	$F_{1,30.25}$ = 0.008, p = 0.9290	$F_{1,30.78}$ = 0.680, p = 0.4159
ACE*LAC*YST	$F_{1,30.24}$ = 0.004, p = 0.9476	$F_{1,30.21}$ = 0.134, p = 0.7168
ACE*LAC*YST*[Butyrate]	$F_{1,30.17}$ = 0.052, p = 0.8217	$F_{1,31.99}$ = 0.004, p = 0.9533
Analysis of Deviance		
Experimental replicate	X^2_1 = 0, p = 1	X^2_1 = 0, p = 1
R^2		
Marginal	0.285	0.272
Conditional	0.285	0.272
xiv) Glycogen ~ Butyrate		
ANOVA Effect test	***Female***	***Male***
ACE	$F_{1,29.08}$ = 3.886, p = 0.0583	$F_{1,30.01}$ = 6.741, p = 0.0144
LAC	$F_{1,29.12}$ = 1.296, p = 0.2642	$F_{1,30.37}$ = 0.024, p = 0.8788
YST	**$F_{1,29.21}$ = 23.094, p = 4.3 x 10^{-5}**	$F_{1,30.76}$ = 0.816, p = 0.3735
[Butyrate]	$F_{1,30.57}$ = 6.287, p = 0.0177	$F_{1,31.73}$ = 2.098, p = 0.1574
ACE*[Butyrate]	$F_{1,29.56}$ = 0.005, p = 0.9418	$F_{1,30.01}$ = 1.882, p = 0.1803
LAC*[Butyrate]	$F_{1,29.06}$ = 1.963, p = 0.1718	$F_{1,30.10}$ = 0.098, p = 0.7569
YST*[Butyrate]	$F_{1,29.68}$ = 2.146, p = 0.1534	$F_{1,31.46}$ = 0.008, p = 0.9286
ACE*LAC	$F_{1,29.39}$ = 3.780, p = 0.0615	$F_{1,30.08}$ = 1.299, p = 0.2635
ACE*YST	$F_{1,29.05}$ = 7.223, p = 0.0118	$F_{1,30.02}$ = 2.084, p = 0.1593
LAC*YST	$F_{1,29.06}$ = 8.440, p = 0.0070	$F_{1,30.02}$ = 0.101, p = 0.7526
ACE*LAC*[Butyrate]	$F_{1,28.41}$ = 1.487, p = 0.2327	$F_{1,31.20}$ = 0.867, p = 0.3588
ACE*YST*[Butyrate]	$F_{1,29.11}$ = 1.495, p = 0.2313	$F_{1,30.46}$ = 0.100, p = 0.7543
LAC*YST*[Butyrate]	$F_{1,29.65}$ = 1.465, p = 0.2357	$F_{1,30.17}$ = 0.053, p = 0.8199
ACE*LAC*YST	$F_{1,29.70}$ = 0.231, p = 0.6341	$F_{1,31.07}$ = 0.048, p = 0.8273
ACE*LAC*YST*[Butyrate]	$F_{1,29.66}$ = 0.060, p = 0.8088	$F_{1,30.44}$ = 0.031, p = 0.8622
Analysis of Deviance		
Experimental replicate	X^2_1 = 0.46, p = 0.4963	**X^2_1 = 6.35, p = 0.0118**
R^2		
Marginal	0.570	0.228
Conditional	0.604	0.470

xv) Trehalose ~ Butyrate		
ANOVA Effect test	***Female (sqrt-transformed)***	***Male (sqrt-transformed)***
ACE	$F_{1,29.16}$ = 0.000, p = 0.9847	$F_{1,30.06}$ = 0.150, p = 0.7013
LAC	$F_{1,29.23}$ = 1.376, p = 0.2503	$F_{1,31.53}$ = 0.464, p = 0.5007
YST	$F_{1,29.38}$ = 6.001, p = 0.0205	$F_{1,32.00}$ = 2.776, p = 0.1055
[Butyrate]	$F_{1,24.74}$ = 0.009, p = 0.9263	$F_{1,22.88}$ = 0.283, p = 0.6000
ACE*[Butyrate]	$F_{1,30.03}$ = 0.639, p = 0.4305	$F_{1,30.08}$ = 0.025, p = 0.8766
LAC*[Butyrate]	$F_{1,29.12}$ = 0.005, p = 0.9440	$F_{1,30.52}$ = 1.568, p = 0.2201
YST*[Butyrate]	$F_{1,30.17}$ = 0.310, p = 0.5817	$F_{1,25.48}$ = 0.210, p = 0.6510
ACE*LAC	$F_{1,29.73}$ = 4.091, p = 0.0522	$F_{1,30.36}$ = 1.358, p = 0.2530
ACE*YST	$F_{1,29.10}$ = 0.135, p = 0.7163	$F_{1,30.12}$ = 0.363, p = 0.5515
LAC*YST	$F_{1,29.12}$ = 5.802, p = 0.0226	$F_{1,30.16}$ = 9.627, p = 0.0041
ACE*LAC*[Butyrate]	$F_{1,14.72}$ = 0.285, p = 0.6017	$F_{1,28.35}$ = 0.086, p = 0.7711
ACE*YST*[Butyrate]	$F_{1,29.22}$ = 0.205, p = 0.6542	$F_{1,31.85}$ = 0.184, p = 0.6707
LAC*YST*[Butyrate]	$F_{1,30.25}$ = 0.027, p = 0.8699	$F_{1,30.78}$ = 0.165, p = 0.6875
ACE*LAC*YST	$F_{1,30.24}$ = 0.131, p = 0.7197	$F_{1,30.21}$ = 0.014, p = 0.9070
ACE*LAC*YST*[Butyrate]	$F_{1,30.17}$ = 0.143, p = 0.7078	$F_{1,31.99}$ = 0.081, p = 0.7778
Analysis of Deviance		
Experimental replicate	$X^2_1 = 0$, p = 1	$X^2_1 = 0$, p = 1
R^2		
Marginal	0.344	0.372
Conditional	0.344	0.372

P-values below the threshold are bolded.