Table S1. Peak information, relative intensity and *p* -value of Hydrophilic compounds

Compound name	RI[a]	Quantitative *m/z*	Relative peak height (mean ± SD)[b]					*p* -value[c]	
			0 week	18 weeks				Control vs. LAB +	Control vs. Acid +
				Control	LAB + EtO	Acid + Yea	Acid + EtOH		
Lactic acid	1050.89	87	0.004±0.00	0.075±0.00	0.078±0.00	0.065±0.00	0.061±0.006	0.489	0.141
Alanine	1094.65	116	0.404±0.07	1.760±0.22	1.449±0.13	1.416±0.08	1.092±0.072	0.174	0.120
Valine	1207.39	144	0.295±0.03	1.105±0.10	0.943±0.07	1.224±0.07	1.029±0.024	0.151	0.269
Glycerol	1260.98	147	0.676±0.03	2.461±0.08	0.732±0.01	2.447±0.15	0.784±0.017	< 0.01 *	0.920
Phosphate	1261.06	299	0.273±0.02	0.999±0.02	0.970±0.03	1.042±0.00	0.997±0.009	0.430	0.084
Leucine	1263.10	158	0.409±0.04	1.645±0.08	1.460±0.11	1.825±0.08	1.596±0.009	0.137	0.109
Isoleucine	1284.84	158	0.228±0.02	0.926±0.05	0.787±0.04	1.006±0.05	0.870±0.025	0.049	0.221
Proline	1293.33	142	0.346±0.06	1.307±0.19	1.039±0.11	1.582±0.09	1.296±0.039	0.166	0.142
Glycine	1299.05	174	0.367±0.02	1.022±0.05	0.976±0.04	1.186±0.04	1.060±0.007	0.365	0.025
Succinic acid (or aldehyde)	1306.40	147	0.066±0.00	0.164±0.01	0.062±0.00	0.160±0.00	0.066±0.002	< 0.01 *	0.695
Serine	1348.11	204	0.192±0.02	0.563±0.03	0.486±0.02	0.785±0.03	0.657±0.021	0.064	< 0.01 *
Threonine	1373.21	218	0.062±0.00	0.200±0.01	0.175±0.00	0.224±0.00	0.184±0.004	0.065	0.060
Malic acid	1474.32	147	0.155±0.01	0.162±0.02	0.148±0.01	0.183±0.00	0.166±0.009	0.481	0.295
meso -Erythritol	1488.33	147	0.477±0.03	0.454±0.02	0.407±0.03	0.487±0.01	0.424±0.005	0.135	0.157
Aspartic acid	1507.17	232	0.272±0.02	0.673±0.05	0.563±0.06	1.107±0.02	0.984±0.004	0.154	< 0.01 *
Methionine	1513.65	176	0.035±0.00	0.128±0.01	0.112±0.01	0.134±0.00	0.120±0.004	0.193	0.533
Pyroglutamic acid	1519.72	156	0.164±0.05	0.404±0.08	0.579±0.00	0.288±0.07	0.445±0.136	0.104	0.214
Glutamic acid	1606.99	246	0.708±0.07	1.619±0.09	1.388±0.06	1.826±0.09	1.479±0.046	0.052	0.096
Phenylalanine	1624.37	218	0.112±0.00	0.409±0.01	0.367±0.01	0.430±0.00	0.374±0.007	0.041	0.135
Xylose	1634.02	103	0.488±0.05	0.286±0.02	0.260±0.02	0.358±0.02	0.346±0.014	0.382	0.037
Arabinose	1641.31	103	0.484±0.05	0.183±0.02	0.151±0.01	0.503±0.02	0.471±0.044	0.200	< 0.01 *
Ribose	1655.47	147	0.022±0.00	0.008±0.00	0.008±0.00	0.012±0.00	0.012±0.000	0.975	< 0.01 *
Xylitol	1682.93	217	0.015±0.00	0.041±0.00	0.031±0.00	0.030±0.00	0.018±0.001	< 0.01 *	< 0.01 *
Arabitol	1696.87	217	0.969±0.04	1.214±0.06	0.980±0.02	1.255±0.06	0.978±0.022	< 0.01 *	0.526
Glutamine	1763.13	156	0.004±0.00	0.005±0.00	0.005±0.00	0.004±0.00	0.004±0.001	0.599	0.165
Citric acid + Isocitric acid	1800.10	147	0.029±0.00	0.003±0.00	0.004±0.00	0.043±0.00	0.040±0.003	0.361	< 0.01 *
Ornithine	1803.90	142	0.138±0.01	1.007±0.09	0.810±0.07	0.303±0.02	0.242±0.014	0.085	< 0.01 *
Fructose	1847.48	103	0.018±0.00	0.005±0.00	0.007±0.00	0.016±0.00	0.036±0.002	0.036	< 0.01 *
Galactose	1868.19	205	0.149±0.01	0.281±0.01	0.264±0.00	0.301±0.01	0.278±0.002	0.152	0.171
Glucose	1875.81	147	1.638±0.16	1.044±0.04	1.719±0.09	1.479±0.10	1.500±0.106	< 0.01 *	< 0.01 *
Mannitol	1905.36	205	0.193±0.00	0.175±0.00	0.174±0.00	0.219±0.00	0.198±0.012	0.865	< 0.01 *

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				Control	LAB + EtO	Acid + Yea	Acid + EtOH		
Lysine	1908.12	174	0.186±0.01	0.508±0.04	0.465±0.01	0.531±0.01	0.474±0.005	0.261	0.524
Histidine	1912.76	154	0.039±0.00	0.129±0.02	0.102±0.01	0.157±0.01	0.116±0.014	0.217	0.209
Tyrosine	1929.67	218	0.139±0.01	0.169±0.00	0.186±0.00	0.189±0.00	0.201±0.005	< 0.01 *	0.012
Inositol	2072.92	217	0.024±0.00	0.168±0.00	0.158±0.00	0.173±0.00	0.162±0.003	0.091	0.301
Tryptophan	2214.31	202	0.018±0.00	0.005±0.00	0.046±0.00	0.003±0.00	0.033±0.003	< 0.01 *	0.225

a: Retention indices (RI) were determined using n-alkanes C11–C32

b: Relative intensity of compounds are displayed as mean ± standard deviation for three independent experiments. Control: control samples inoculated with *Zygosaccharomyces rouxii* and *Tetragenococcus halophilus* . LAB + EtOH: Samples inoculated with *T. halophllus* and added ethanol.
Acid + Yeast: Samples added lactic acid and acetic acid and inoculated with *Z. rouxii* . Acid + EtOH: Sample added lactic acid, acetic acid and ethanol.

c: *p* -value are calcurated by AIoutout 2 software. Significant constituents were marked.