

**Table S1.** A complete breakdown of men’s micronutrient and macronutrient intake.

Men’s Nutrient In- take Profile	Intake Data			P-value		
	Normal	Overweight	Obese	Normal vs. Over- weight	Normal vs. Obese	Overweight vs. Obese
Calories (kcal)	2849.22±1416.42	2593.05±1122.78	3887.58±2783.63	0.7328	0.3559	0.1958
Protein (g)	130.43±54.86	104.87±40.76	167.99±128.71	0.3870	0.4437	0.1667
Tryptophan (g)	1.31±0.5	1.07±0.43	1.6±1.26	0.3764	0.5360	0.2289
Threonine (g)	4.5±1.64	3.51±1.26	5.89±4.61	0.2750	0.4086	0.1438
Isoleucine (g)	5.53±2.24	4.26±1.56	6.95±5.37	0.2970	0.4830	0.1564
Leucine (g)	10.03±4.17	7.59±2.84	12.05±9.02	0.2814	0.5642	0.1640
Lysine (g)	8.31±3.28	6.08±2.16	10.46±8.44	0.2163	0.4944	0.1419
Methionine (g)	2.7±1.05	2.06±0.75	3.43±2.71	0.2694	0.4674	0.1531
Cysteine (g)	1.89±1.12	1.48±0.63	2.12±1.59	0.4685	0.7588	0.2571
Phenylalanine (g)	5.42±2.19	4.32±1.67	6.71±5.03	0.3535	0.5019	0.1798
Tyrosine (g)	4.23±1.81	3.23±1.21	5.16±4	0.3082	0.5446	0.1723
Valine (g)	6.32±2.59	4.88±1.83	7.82±5.99	0.3076	0.5104	0.1658
Arginine (g)	6.46±2.42	5.03±1.75	8.51±6.83	0.2819	0.4123	0.1488
Histamine (g)	3.41±1.28	2.58±0.94	4.24±3.25	0.2412	0.4928	0.1492
Alanine (g)	5.88±2.24	4.48±1.55	7.95±6.28	0.2534	0.3703	0.1201
Aspartic acid (g)	10.67±4.31	8.23±2.95	13.6±10.97	0.2964	0.4726	0.1639
Glutamic acid (g)	22.47±9.72	18.8±7.58	28.27±20.91	0.4818	0.4760	0.2023
Glycine (g)	4.95±2.09	4±1.38	7.02±5.52	0.3889	0.3161	0.1233
Proline (g)	8.06±4.05	6.69±2.77	9.94±7.01	0.5205	0.5230	0.1967
Serine (g)	5.64±2.42	4.44±1.73	6.91±5.19	0.3548	0.5284	0.1786
Hydroxyproline (g)	0.29±0.27	0.17±0.06	0.33±0.37	0.3787	0.8009	0.1992
Carbohydrate (g)	340.68±154.57	350.84±199.65	524.63±401.48	0.9139	0.2261	0.2382
Glucose (g)	15.3±8.07	17.5±9.21	43.51±66.58	0.6404	0.2175	0.2508
Fructose (g)	16.91±8.57	20.57±10.61	48.56±71.47	0.4814	0.1991	0.2501
Galactose (g)	0.14±0.11	0.12±0.06	0.19±0.17	0.6623	0.5323	0.2277
Sucrose (g)	28.57±21.22	26.21±17.63	35.42±30.75	0.8353	0.6237	0.4201
Lactose (g)	31.31±46.12	20.52±15.6	17.94±24.09	0.6344	0.5690	0.7770
Maltose (g)	0.87±0.6	0.71±0.22	2.03±2.11	0.5943	0.1319	0.0793
Starch (g)	47.6±23.79	38.62±18.86	59.67±43.53	0.4829	0.5004	0.1829
Fiber (g)	28.85±15.2	28.05±16.52	41.8±34.24	0.9270	0.3297	0.2701
Total Fat (g)	106.24±63.79	87.57±33.78	130.94±89.35	0.5643	0.5510	0.1759
Trans fat (g)	2.19±2.66	1.39±0.57	1.99±1.5	0.5418	0.8796	0.2626
Trans-MUFA (g)	1.47±1.8	0.99±0.42	1.46±1.15	0.5873	0.9908	0.2516
Trans-PUFA (g)	0.37±0.51	0.2±0.09	0.29±0.25	0.4948	0.7347	0.3317
Saturated Fat (g)	32.89±19.11	28.77±12.08	41.9±29.41	0.6743	0.4893	0.2135
Butyric acid (g)	0.68±0.48	0.62±0.4	0.81±0.67	0.7973	0.6794	0.4393
Caproic acid (g)	0.37±0.25	0.36±0.25	0.44±0.35	0.9037	0.7104	0.5749
Caprylic acid (g)	0.28±0.17	0.29±0.21	0.34±0.33	0.8892	0.6170	0.6803
Capric acid (g)	0.49±0.32	0.49±0.29	0.6±0.5	0.9956	0.6123	0.5444
Lauric acid (g)	0.61±0.43	0.76±0.68	0.9±0.89	0.6068	0.4122	0.6904
Myristic acid (g)	2.62±1.53	2.36±1.27	3.31±2.68	0.7458	0.5376	0.3232
Palmitic acid (g)	18.46±10.44	15.67±6.35	23.42±16.09	0.6015	0.4866	0.1802
Stearic acid (g)	8.2±5.09	7.38±3.07	10.84±7.59	0.7517	0.4409	0.2042
Arachidic acid (g)	0.22±0.17	0.15±0.08	0.21±0.14	0.4421	0.8738	0.3071
Behenic acid (g)	0.21±0.24	0.14±0.13	0.16±0.17	0.5662	0.6727	0.7953
MUFA (g)	42.65±25.16	34.96±12.84	50.81±33.89	0.5469	0.6104	0.1911
Myristoleic acid (g)	0.12±0.1	0.09±0.04	0.1±0.07	0.4642	0.6792	0.5801
Palmitoleic acid (g)	1.61±0.82	1.31±0.51	2.16±1.52	0.4781	0.3764	0.1181
Erucic acid (g)	0.04±0.07	0.05±0.09	0.09±0.21	0.8191	0.5262	0.6005
Gadoleic acid (g)	0.33±0.2	0.27±0.12	0.38±0.26	0.5246	0.7178	0.2426
Oleic acid (g)	38.8±22.82	32.02±11.81	46.57±31.15	0.5580	0.5948	0.1915
Elaidic acid (g)	10.42±7.65	6.96±2.83	9.75±6.02	0.3758	0.8687	0.2049
Vaccenic acid (g)	1.3±1.64	0.96±0.5	1.16±1.1	0.6779	0.8732	0.6124
Rumenic acid (g)	0.04±0.03	0.02±0.01	0.03±0.03	0.2846	0.9631	0.0741
PUFA (g)	23.23±16.23	17.36±7.1	27.41±19.42	0.4753	0.66952	0.1500
Linoleic acid (g)	20.54±14.74	15.29±6.31	23.98±17.12	0.4806	0.6962	0.1576
Linolenic acid (g)	1.98±1.05	1.57±0.67	2.58±1.85	0.4639	0.4358	0.1326
Arachidonic acid (g)	0.2±0.05	0.16±0.09	0.26±0.2	0.2535	0.4050	0.1741
DPA (g)	0.01±0	0.01±0.01	0.02±0.03	0.9730	0.4321	0.4428
EPA (g)	0.02±0.01	0.02±0.01	0.04±0.06	0.8276	0.4708	0.5093

DHA (g)	0.07±0.06	0.05±0.03	0.13±0.23	0.5489	0.4659	0.3303
Cholesterol (mg)	473.65±93.69	367.07±200.98	536.97±390.65	0.1702	0.6370	0.2385
Stigmasterol (mg)	6.52±5.39	4.21±2.71	7.42±5.06	0.4068	0.7643	0.0970
Campesterol (mg)	16.26±6.33	10.88±4.51	17.91±8.79	0.1378	0.6850	0.0404
Daidzein (mg)	0.21±0.14	0.12±0.05	0.17±0.14	0.2265	0.6315	0.3041
Genistein (mg)	0.17±0.13	0.12±0.06	0.15±0.13	0.4863	0.8062	0.5497
Caffeine (mg)	198.7±189.28	83.57±101.24	122.5±128.21	0.2561	0.4483	0.4535
Vitamin C (mg)	141.54±75.42	137.44±54.12	365.14±457.02	0.9165	0.1630	0.1510
Thiamin (mg)	2.22±0.91	2.41±1.43	3.7±2.74	0.7549	0.1470	0.2034
Riboflavin (mg)	3.58±2.48	3.02±1.66	4.55±3.6	0.6643	0.5554	0.2437
Niacin (mg)	34.14±13.41	30.35±16.23	50.63±38.03	0.6358	0.2427	0.1445
Pantothenic acid (mg)	8.86±4.59	6.69±2.94	10.5±8.26	0.3733	0.6307	0.1956
Pyridoxine (mg)	3.17±1.28	2.72±1.37	5.24±4.45	0.5469	0.1986	0.1155
Cobalamin (µg)	10.82±7.98	10.42±9.93	12.6±10.86	0.9336	0.7253	0.6371
Choline (mg)	547.94±227.67	431.35±170.17	690.01±583.89	0.3451	0.5126	0.2058
Folic acid (µg)	201.95±58.97	282.87±221.38	548.4±678.01	0.2806	0.1422	0.2625
Folate (µg)	355.32±172.62	323.51±168.99	612.87±742.9	0.7402	0.3205	0.2568
Vitamin A (IU)	8755.17±6155.35	8216±4851.85	25178.78±42184.34	0.8680	0.2564	0.2373
Retinol (µg)	952.38±848.97	901.65±940.88	877.07±852.74	0.9172	0.8755	0.9506
RAE (µg)	1244.65±979.47	1168.2±975.19	2012.48±2768.39	0.8885	0.4476	0.3802
β-carotene (µg)	3138.56±2453.9	2766.77±1783.66	12516.57±23555.22	0.7712	0.2431	0.2238
α-carotene (µg)	516.09±216.24	595.73±550.67	1578±2090.27	0.6849	0.1450	0.1797
Vitamin E (mg)	11.38±6.78	8.37±3	16.92±16.81	0.3863	0.3827	0.1453
Vitamin D (IU)	400.41±492.74	289.24±194.16	334.95±391.05	0.6483	0.8035	0.7437
Vitamin D2 (µg)	0.01±0.01	0±0.01	0.02±0.03	0.5093	0.4221	0.2279
Vitamin D3 (µg)	9.36±12.12	6.17±3.82	7.32±9.41	0.5933	0.7518	0.7252
Vitamin D (µg)	9.98±12.27	7.21±4.85	8.32±9.72	0.6480	0.8006	0.7479
Cryptoxanthin (µg)	152.42±61.4	157.71±100.05	498.45±768.89	0.8989	0.1902	0.1968
Lycopene	9727.87±7756.66	8131.87±4076.88	18930.63±32829	0.6825	0.4187	0.3279
Lutein (µg)	2337.18±1853.43	2372.47±1547.51	12382.28±26801.91	0.9715	0.2679	0.2684
Betaine (µg)	64.96±29.39	61.15±31.77	125.68±177.86	0.8203	0.3181	0.2857
β-tocopherol (mg)	0.13±0.08	0.11±0.04	0.16±0.14	0.6144	0.6228	0.3001
γ-tocopherol (mg)	7.91±5.34	6.36±3.26	10.12±7.82	0.5726	0.5336	0.1840
δ-tocopherol (mg)	1.56±1.17	1.41±0.76	2.19±1.75	0.8017	0.4256	0.2167
Vitamin K (µg)	143.99±90.21	109.78±61.64	517.89±1132.65	0.4715	0.3260	0.2844
Calcium (mg)	1638.77±1318.06	1335.84±585.56	1993.93±1579.95	0.6445	0.6560	0.2396
Iron (mg)	21.81±9	22.72±14.22	40.82±32.48	0.8805	0.1120	0.1296
Magnesium (mg)	486.81±265.34	407.73±166.5	686.17±604.28	0.5639	0.3916	0.1884
Phosphorus (mg)	2319.14±1194.68	1819.66±787.33	2673.14±1991.9	0.4277	0.6756	0.2298
Potassium (mg)	4485.62±2460.57	3666.37±1529.95	6383.01±5808.11	0.5204	0.3918	0.1815
Sodium (mg)	4527.76±2041.31	4264±1983.85	6723.68±5124.26	0.8154	0.2593	0.1812
Zinc (mg)	18.76±9.66	15.45±6.19	26.18±19.85	0.5100	0.3478	0.1305
Copper (mg)	2.24±1.53	2.31±1.72	2.81±2.27	0.9346	0.5748	0.5803
Manganese (mg)	3.71±1.81	4.09±2.33	6.79±5.71	0.7296	0.1459	0.1896
Selenium (µg)	167.36±61.53	142.11±60.77	214.31±158.6	0.4677	0.4270	0.2026

Data are represented by mean±SD; *P* < 0.05 represents a significant difference and is bolded

**Table S2.** A complete breakdown of women’s micronutrient and macronutrient intake.

Women’s Nutrient In- take Profile	Intake Data			P-value		
	Normal	Overweight	Obese	Normal vs. Over- weight	Normal vs. Obese	Overweight vs. Obese
Calories (kcal)	1920.13±682.75	1938.09±976.16	3325.58±1294.92	0.9585	<b>0.0006</b>	<b>0.0034</b>
Protein (g)	82.41±30.77	79.53±38.03	139.89±55.75	0.8371	<b>0.0011</b>	<b>0.0022</b>
Tryptophan (g)	0.83±0.34	0.82±0.39	1.41±0.59	0.9247	<b>0.0019</b>	<b>0.0038</b>
Threonine (g)	2.68±0.99	2.73±1.28	4.75±1.95	0.9202	<b>0.0007</b>	<b>0.0027</b>
Isoleucine (g)	3.34±1.27	3.29±1.66	5.81±2.3	0.9426	<b>0.0007</b>	<b>0.0024</b>
Leucine (g)	6±2.33	5.99±3.1	10.42±4.17	0.9956	<b>0.0008</b>	<b>0.0035</b>
Lysine (g)	4.79±1.77	4.8±2.51	8.51±3.57	0.9901	<b>0.0008</b>	<b>0.0034</b>
Methionine (g)	1.6±0.61	1.62±0.81	2.82±1.16	0.9528	<b>0.0008</b>	<b>0.0034</b>
Cysteine (g)	1.12±0.53	1.14±0.8	1.89±0.74	0.9493	<b>0.0019</b>	<b>0.0222</b>
Phenylalanine (g)	3.38±1.3	3.35±1.67	5.86±2.31	0.9567	<b>0.0008</b>	<b>0.0026</b>
Tyrosine (g)	2.59±1.01	2.53±1.28	4.52±1.84	0.8995	<b>0.0009</b>	<b>0.0024</b>
Valine (g)	3.91±1.45	3.84±1.96	6.77±2.73	0.9253	<b>0.0009</b>	<b>0.0028</b>
Arginine (g)	3.64±1.35	3.88±1.86	6.69±2.82	0.7120	<b>0.0005</b>	<b>0.0038</b>
Histamine (g)	1.98±0.76	2.03±0.99	3.51±1.49	0.8976	<b>0.0010</b>	<b>0.0039</b>
Alanine (g)	3.27±1.21	3.5±1.68	6.09±2.57	0.6988	<b>0.0005</b>	<b>0.0035</b>
Aspartic acid (g)	6.23±2.18	6.4±3.22	11.02±4.49	0.8841	<b>0.0007</b>	<b>0.0039</b>
Glutamic acid (g)	14.86±6.04	14.34±7.28	25.47±10.08	0.8452	<b>0.0010</b>	<b>0.0023</b>
Glycine (g)	2.76±1.04	3.08±1.51	5.53±2.99	0.5490	<b>0.0018</b>	<b>0.0084</b>
Proline (g)	5.54±2.33	5.12±2.77	9.59±3.78	0.6809	<b>0.0009</b>	<b>0.0013</b>
Serine (g)	3.5±1.33	3.41±1.76	6.1±2.35	0.8811	<b>0.0006</b>	<b>0.0020</b>
Hydroxyproline (g)	0.1±0.07	0.13±0.08	0.2±0.1	0.3875	<b>0.0038</b>	<b>0.0477</b>
Carbohydrate (g)	268.1±96.42	264.76±152.07	428.54±178.08	0.9494	<b>0.0033</b>	<b>0.0157</b>
Glucose (g)	14.83±8.99	14.54±9.14	22±14.97	0.9365	0.1050	0.1141
Fructose (g)	17.33±10.44	14.59±6.53	24.56±16.87	0.4103	0.1482	0.0389
Galactose (g)	0.07±0.03	0.1±0.12	0.15±0.08	0.4326	<b>0.0015</b>	0.2897
Sucrose (g)	16.68±10.98	21.3±30.76	30.75±20.5	0.6416	<b>0.0204</b>	0.3826
Lactose (g)	18.01±16.23	15.23±24.98	22.41±18.87	0.7492	0.4773	0.4261
Maltose (g)	0.61±0.36	1.14±1.4	1.15±0.55	0.2493	<b>0.0023</b>	0.9705
Starch (g)	37.45±18.5	33.92±26.97	49.53±17.24	0.7110	0.0621	0.1081
Fiber (g)	24.28±9.69	23.59±10.12	37.76±19.25	0.8605	<b>0.0172</b>	<b>0.0176</b>
Total Fat (g)	61.23±22.98	63.94±28.78	123.44±49.54	0.7969	<b>0.0001</b>	<b>0.0005</b>
Trans fat (g)	0.96±0.36	1±0.6	2.18±1.27	0.8602	<b>0.0013</b>	<b>0.0029</b>
Trans-MUFA (g)	0.68±0.27	0.7±0.41	1.62±1	0.8682	<b>0.0015</b>	<b>0.0028</b>
Trans-PUFA (g)	0.12±0.05	0.14±0.1	0.3±0.18	0.5896	<b>0.0007</b>	<b>0.0043</b>
Saturated Fat (g)	21.26±9.11	21.11±10.26	42.6±18.74	0.9690	<b>0.0003</b>	<b>0.0006</b>
Butyric acid (g)	0.56±0.31	0.52±0.44	1.07±0.62	0.7867	<b>0.0061</b>	<b>0.0110</b>
Caproic acid (g)	0.31±0.2	0.27±0.22	0.54±0.33	0.6341	<b>0.0217</b>	<b>0.0152</b>
Caprylic acid (g)	0.24±0.17	0.2±0.13	0.39±0.24	0.4719	0.0511	<b>0.0115</b>
Capric acid (g)	0.42±0.23	0.37±0.28	0.73±0.41	0.6604	<b>0.0105</b>	<b>0.0096</b>
Lauric acid (g)	0.57±0.39	0.47±0.31	0.91±0.54	0.4678	<b>0.0413</b>	<b>0.0096</b>
Myristic acid (g)	2.01±1.09	1.83±1.03	3.77±1.94	0.6672	<b>0.0034</b>	<b>0.0020</b>
Palmitic acid (g)	11.28±4.54	11.54±5.45	22.8±9.56	0.8991	<b>0.0002</b>	<b>0.0005</b>
Stearic acid (g)	5.17±2.19	5.25±2.45	11.03±5.13	0.9309	<b>0.0003</b>	<b>0.0005</b>
Arachidic acid (g)	0.1±0.04	0.11±0.05	0.21±0.09	0.5508	<b>0.0002</b>	<b>0.0011</b>
Behenic acid (g)	0.08±0.06	0.09±0.05	0.15±0.08	0.6503	<b>0.0071</b>	<b>0.0166</b>
MUFA (g)	23.21±8.4	26.17±14.34	48.94±19.77	0.5473	<b>6.602E-05</b>	<b>0.0016</b>
Myristoleic acid (g)	0.06±0.03	0.07±0.08	0.13±0.06	0.7273	<b>0.0011</b>	<b>0.0590</b>
Palmitoleic acid (g)	0.9±0.37	1.06±0.56	1.92±0.79	0.4357	<b>0.0001</b>	<b>0.0024</b>
Erucic acid (g)	0.07±0.1	0.19±0.56	0.04±0.05	0.4830	0.4253	0.4091
Gadoleic acid (g)	0.18±0.08	0.22±0.19	0.33±0.15	0.4669	<b>0.0008</b>	0.1179
Oleic acid (g)	21.38±7.84	23.42±10.88	44.89±18.21	0.6016	<b>0.0001</b>	<b>0.0006</b>
Elaidic acid (g)	4.16±1.48	5.18±3.87	9.86±4	0.4225	<b>2.053E-05</b>	<b>0.0054</b>
Vaccenic acid (g)	0.5±0.24	0.61±0.61	1.37±0.95	0.5606	<b>0.0018</b>	<b>0.0164</b>
Rumenic acid (g)	0.02±0.01	0.02±0.02	0.04±0.02	0.7076	<b>0.0046</b>	<b>0.0245</b>
PUFA (g)	11.84±4.42	12.01±4.73	22.99±8.4	0.9263	<b>6.358E-05</b>	<b>0.0002</b>
Linoleic acid (g)	10.39±3.99	10.34±3.93	20.22±7.48	0.9754	<b>7.315E-05</b>	<b>0.0001</b>
Linolenic acid (g)	1.14±0.44	1.18±0.49	2.16±0.86	0.8276	<b>0.0002</b>	<b>0.0007</b>
Arachidonic acid (g)	0.1±0.05	0.12±0.08	0.19±0.09	0.4977	<b>0.0018</b>	<b>0.0449</b>
DPA (g)	0.01±0.01	0.01±0	0.01±0.01	0.2690	0.1815	<b>0.0435</b>
EPA (g)	0.02±0.01	0.02±0.02	0.03±0.02	0.8795	0.1049	0.1322
DHA (g)	0.04±0.02	0.03±0.02	0.07±0.05	0.5017	<b>0.0330</b>	<b>0.0136</b>

Cholesterol (mg)	234.32±120.08	271.48±157.3	467.48±212.24	0.5164	<b>0.0006</b>	<b>0.0096</b>
Stigmasterol (mg)	2.69±1.01	3.16±1.66	6.97±3.5	0.4190	<b>0.0001</b>	<b>0.0007</b>
Campesterol (mg)	7.75±3.49	9.58±4.69	16.87±8.52	0.2863	<b>0.0005</b>	<b>0.0074</b>
Daidzein	1.2±4.42	0.71±2.02	0.38±0.63	0.7003	0.4748	0.6159
Genistein	1.14±4.22	0.83±2.47	0.4±0.78	0.8104	0.5009	0.5911
Caffeine	86.13±118.15	76.38±122.67	86.53±107.83	0.8388	0.9920	0.8250
Vitamin C (mg)	114.1±48.49	131.81±87.76	216.58±192.92	0.5525	<b>0.0480</b>	0.1279
Thiamin (mg)	1.95±1.05	1.85±1.2	3.01±1.6	0.8358	<b>0.0306</b>	<b>0.0384</b>
Riboflavin (mg)	2.73±1.26	2.86±2.23	4.09±2.4	0.8710	0.0509	0.1786
Niacin (mg)	23.7±13.46	25.02±17.3	37.29±19.2	0.8333	<b>0.0249</b>	0.0926
Pantothenic acid (mg)	5.76±2.34	6.46±4.17	9.91±7.27	0.6234	<b>0.0373</b>	0.1229
Pyridoxine (mg)	2.6±1.71	2.51±1.81	3.97±3.32	0.8994	0.1441	0.1445
Cobalamin (μg)	8.98±8.06	18.19±26.29	16.54±18.61	0.2836	0.1405	0.8585
Choline (mg)	320.28±130.4	364.07±214.99	555.12±245.63	0.5552	<b>0.0020</b>	<b>0.0403</b>
Folic acid (μg)	330.94±420.44	204.34±198.65	403.95±340.13	0.3063	0.5890	0.0611
Folate (μg)	275.56±117.03	287.11±134.66	439.21±249.81	0.8199	<b>0.0232</b>	<b>0.0472</b>
Vitamin A (IU)	8568.65±7386.44	9927.23±8951.83	12872.29±11461.5	0.6825	0.2079	0.4543
Retinol	786.08±669.3	1661.5±2421.73	1356.06±1502.85	0.2671	0.1691	0.7134
RAE	1087±866.13	1883.43±2461.79	1780.89±1780.37	0.3238	0.1641	0.9064
β-carotene	3191.09±3124.96	2366.18±865.52	4449.92±4001.75	0.3297	0.3204	0.0526
α-carotene	629.73±926.45	360.81±255.23	825.98±811.34	0.2849	0.5234	<b>0.0393</b>
Vitamin E	7.53±3.96	6.67±2.85	13.27±8.97	0.5166	<b>0.0253</b>	<b>0.0104</b>
Vitamin D (IU)	239.95±157.01	225.55±257.32	322.59±212.86	0.8707	0.2126	0.3111
Vitamin D2	0.11±0.41	0.18±0.56	0.05±0.16	0.7470	0.5551	0.4648
Vitamin D3	5.24±4.19	4.69±6.18	7.16±4.95	0.8005	0.2378	0.2804
Vitamin D (μg)	5.99±3.96	5.59±6.31	8.02±5.33	0.8549	0.2231	0.3051
Cryptoxanthin	128.75±97.15	175.64±201.62	296±287.08	0.4863	0.0347	0.2044
Lycopene	6627.89±4404.32	6640.7±3617.68	14602.45±16412.12	0.9935	0.0690	0.0694
Lutein	2549.08±2060.93	1950.05±671.92	3153.87±3293.36	0.2926	0.5299	0.1613
Betaine	56.42±32.87	47.7±13.08	84.6±68.33	0.3495	0.1411	<b>0.0442</b>
β-tocopherol	0.07±0.03	0.07±0.03	0.14±0.06	0.9950	<b>0.0005</b>	<b>0.0007</b>
γ-tocopherol	3.95±1.89	3.92±1.82	8.19±3.28	0.9703	<b>0.0001</b>	<b>0.0002</b>
δ-tocopherol	0.83±0.45	0.75±0.31	1.96±1.02	0.6149	<b>0.0004</b>	<b>0.0002</b>
Vitamin K	132.96±106.45	107.94±22.36	180.53±165.77	0.3750	0.3324	0.0930
Calcium	1327.63±448.3	1118.5±793.39	2066.82±1190.16	0.4414	<b>0.0266</b>	<b>0.0178</b>
Iron	19.53±12.84	19.99±17.63	28.96±14.69	0.9428	<b>0.0584</b>	<b>0.1773</b>
Magnesium	356.42±112.14	338.67±165.53	535.33±252.55	0.7604	<b>0.0143</b>	<b>0.0195</b>
Phosphorus	1537.85±581.12	1438.61±777.14	2508.04±1128.03	0.7232	<b>0.0045</b>	<b>0.0064</b>
Potassium	3197.34±1123.15	3131.88±1662.87	5038.81±2384.65	0.9107	<b>0.0088</b>	<b>0.0195</b>
Sodium	3217.48±1360.2	3070.92±1584.84	5657.28±2179.03	0.8053	<b>0.0006</b>	<b>0.0012</b>
Zinc	12.79±5.37	12.66±6.52	21.61±13.1	0.9553	<b>0.0181</b>	<b>0.0243</b>
Copper	1.85±1.31	3.63±4.36	3.41±3.1	0.2133	0.0693	0.8872
Manganese	3.64±1.65	3.35±1.79	5.22±2.84	0.6677	0.0608	<b>0.0420</b>
Selenium	110.62±46.84	107.6±53.77	178.61±73.41	0.8814	<b>0.0036</b>	<b>0.0067</b>

Data are represented by mean±SD; *P* < 0.05 represents a significant difference and is bolded

**Table S3.** Men's food group consumption between normal, overweight, and obese subjects.

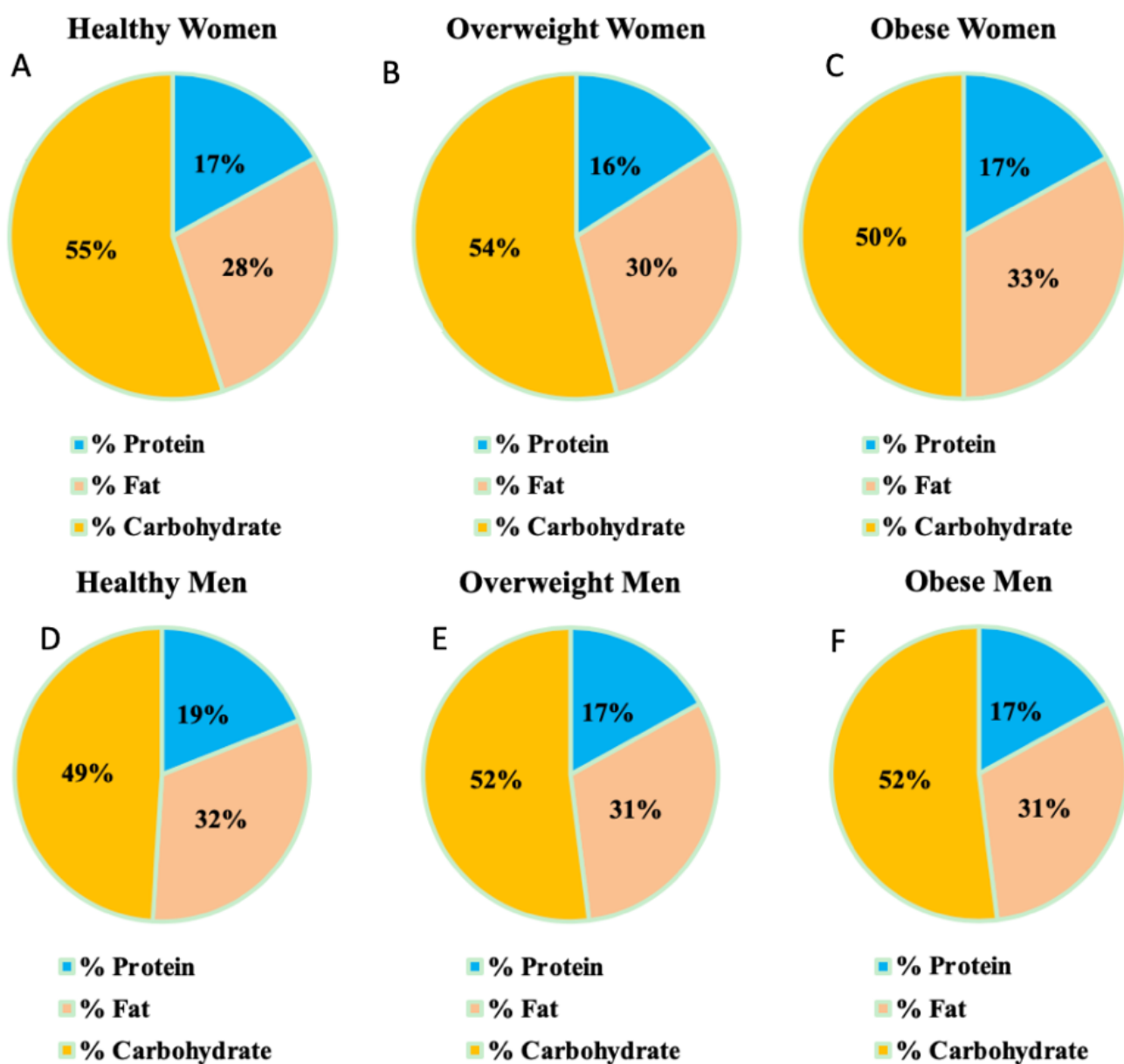
Men's Food Groups	Intake Data			<i>p-value</i>		
	Normal	Overweight	Obese	Normal vs. Overweight	Normal vs. Obese	Overweight vs. Obese
Red Meat (g)	107.21±88.89	84.19±39.49	165.78±188.82	0.6042	0.4289	0.2108
White Meat (g)	72.38±59.89	44.99±33.64	94.21±144.43	0.3813	0.6870	0.3178
Poultry (g)	54.34±56.1	32.46±27.14	51.99±56.28	0.4457	0.9409	0.3374
Fish (g)	16.35±24.72	9.07±8.44	41.44±92.6	0.5531	0.4393	0.2990
Beans (g)	105.4±123.94	92.75±136.7	45.53±26.31	0.8590	0.3433	0.2858
Fruit (g)	154.98±107.28	143.73±102.44	269.16±320.06	0.8489	0.3279	0.2616
Fruit Juice (g)	66.64±71.25	80.74±80.42	544.74±1305.85	0.7615	0.3358	0.3489
Vegetables (g)	151.68±105.09	176.04±120.08	550.91±1010.6	0.6911	0.2465	0.2730

Data are represented by mean±SD;  $P < 0.05$  represents a significant difference and is bolded.

**Table S4.** Women's food group consumption between normal, overweight, and obese subjects.

Women's Food Groups	Intake Data			<i>p-value</i>		
	Normal	Overweight	Obese	Normal vs. Overweight	Normal vs. Obese	Overweight vs. Obese
Red Meat (g)	38.74±25.38	61.37±41.17	101.76±65.28	0.1251	0.0552	<b>0.00134</b>
White Meat (g)	39.57±20.78	30.78±18.95	56.33±37.48	0.2666	<b>0.0253</b>	0.1219
Poultry (g)	28.92±17.25	20.73±18.81	33.95±25.28	0.2636	0.1258	0.5076
Fish (g)	8.19±7.77	6.92±6.1	19.06±17.79	0.6378	<b>0.0170</b>	0.0314
Beans (g)	52.79±61.54	39.89±46.73	83.38±79.01	0.5421	0.2163	0.0747
Fruit (g)	210.64±140.15	176.11±139.38	270.7±227.19	0.5346	0.4175	0.2273
Fruit Juice (g)	62.21±88.97	133.17±95.96	136.18±178.48	0.3298	0.1662	0.9681
Vegetables (g)	202.56±202.37	246.87±146.85	281.27±203.58	0.5159	0.3317	0.6543

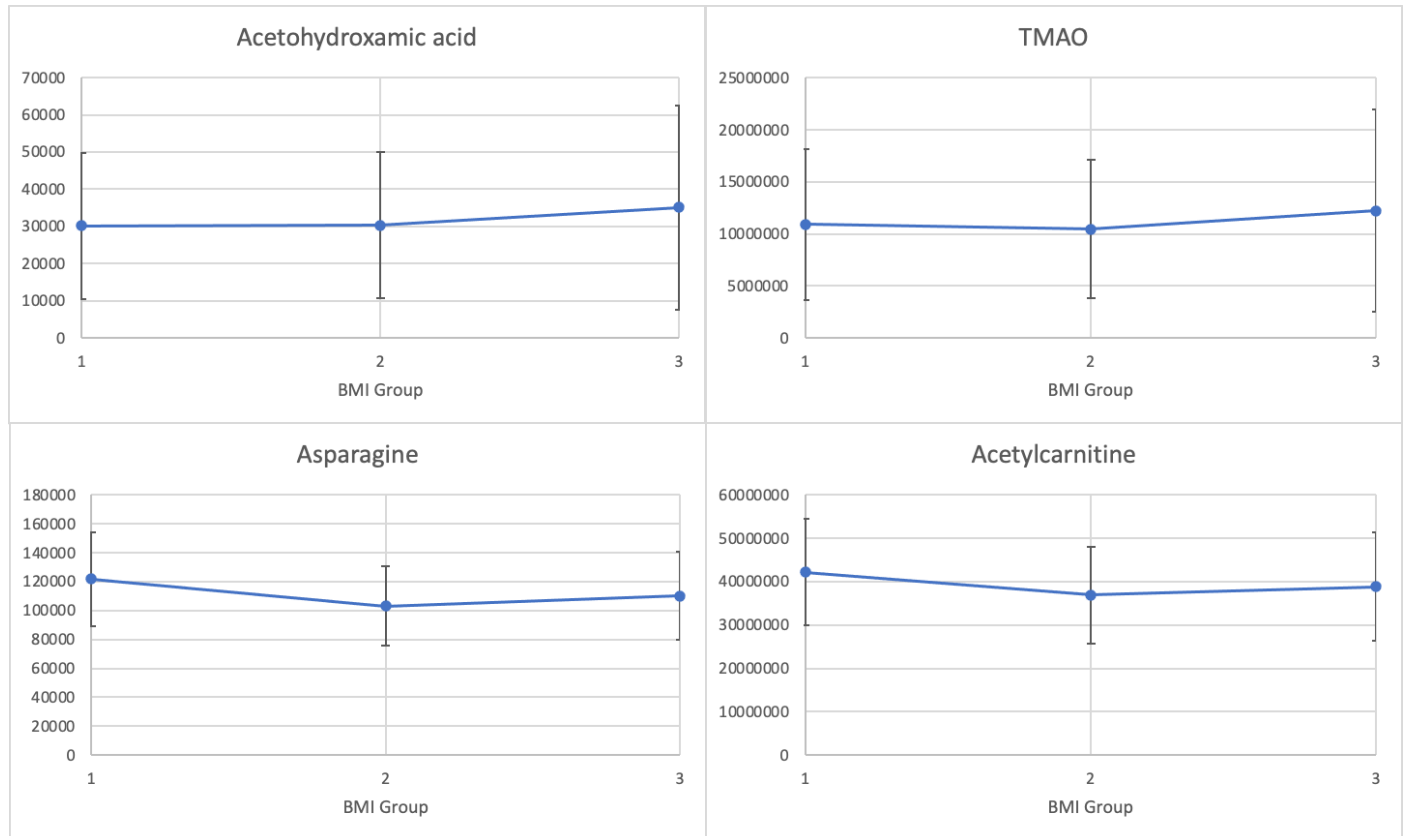
Data are represented by mean±SD;  $P < 0.05$  represents a significant difference and is bolded

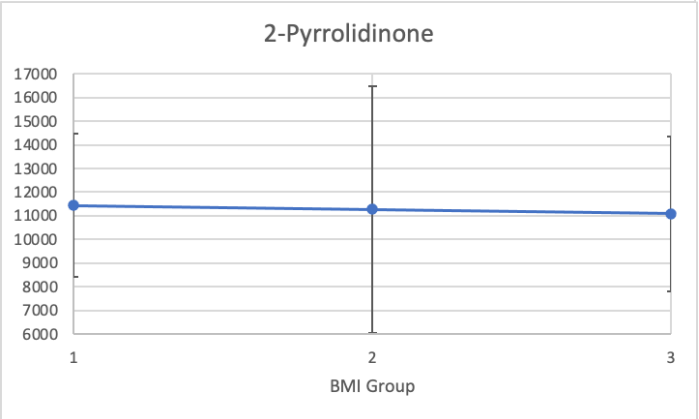
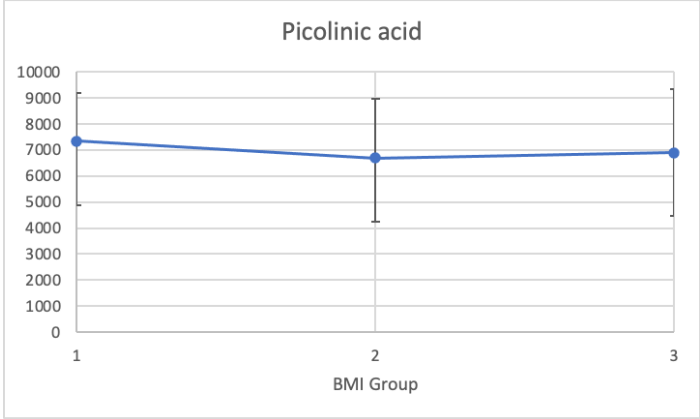
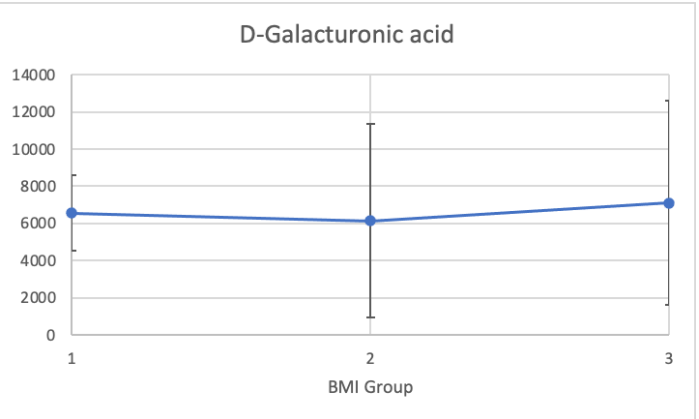
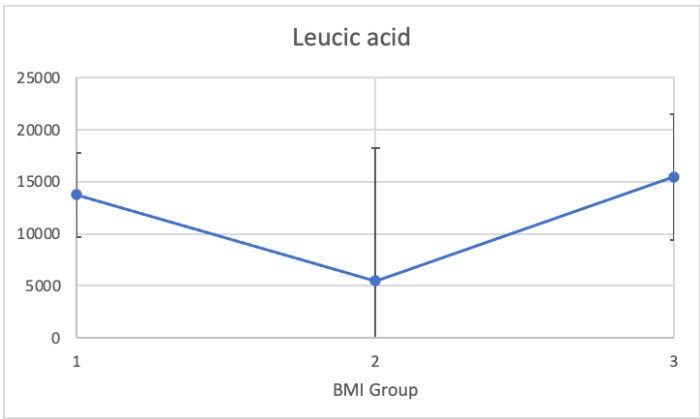
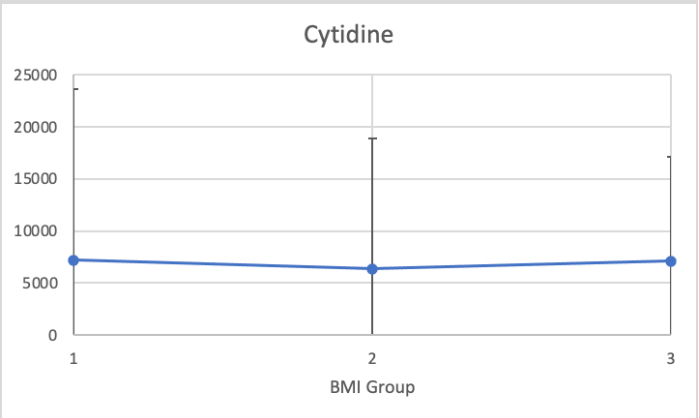
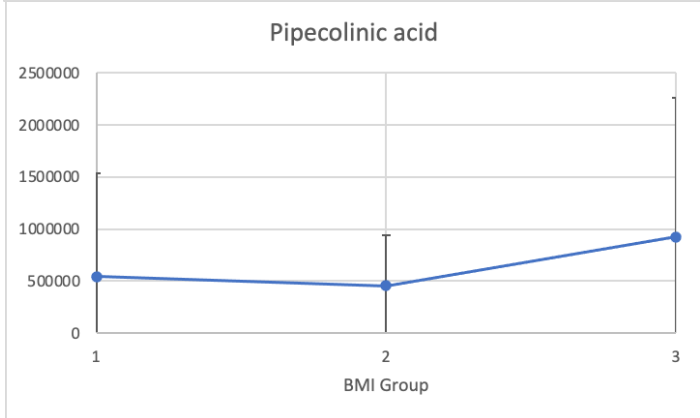
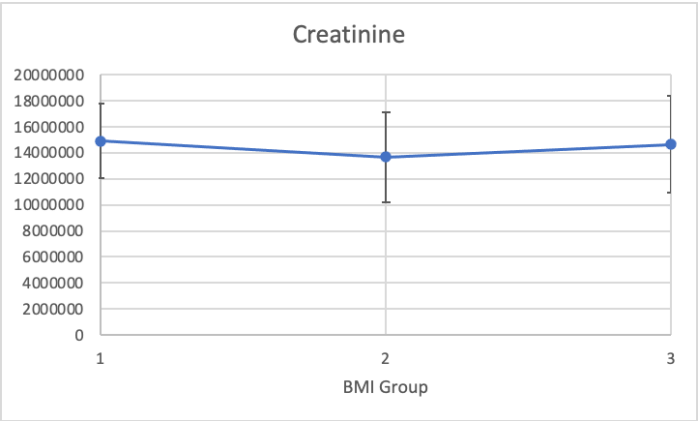
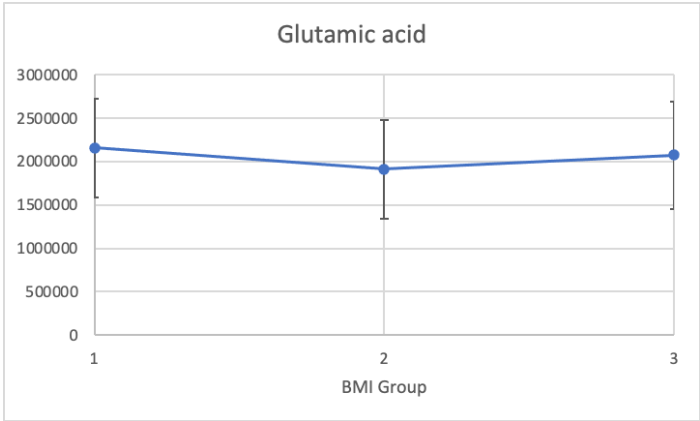


**Figure S1.** Pie charts of macronutrient breakdown between sex and BMI groups: (A) Normal weight women. (B) Overweight women. (C) Obese women. (D) Normal weight men. (E). Overweight men. (F) Obese men.

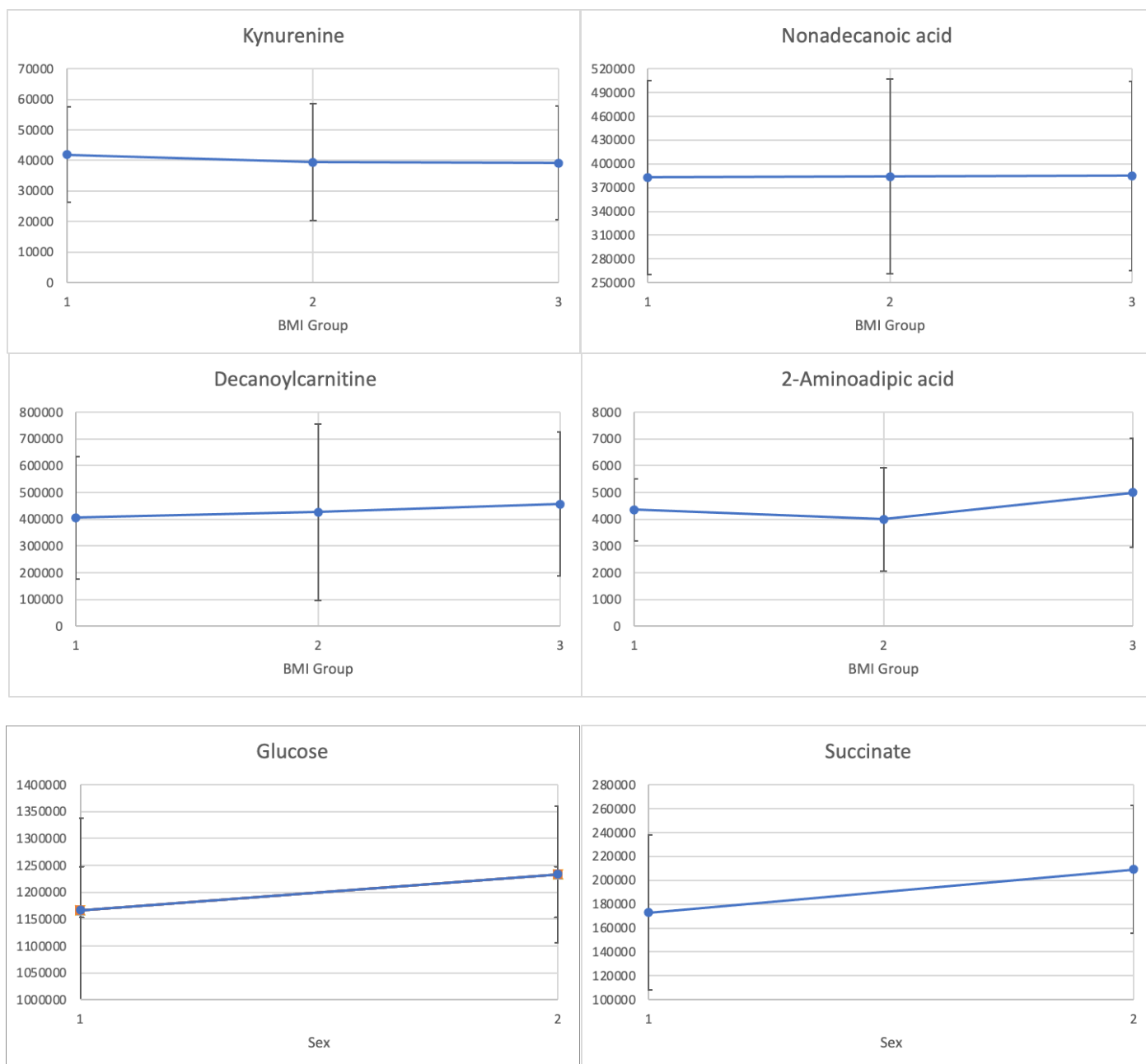
**Table S5.** Significant metabolites by BMI classification for men and women.

BMI				Sex	
Metabolites		Post Hoc		Metabolites	P-Value
	Normal vs. Over-weight	Normal vs. Obese	Overweight vs. Obese		
Acetohydroxamic acid			0.025	Glucose/Galactose	0.005
TMAO			0.038	Succinate	0.032
Acetylcarnitine	0.017			<b>Key</b> Downregulated in Lower BMI Group or Men Upregulated in Lower BMI Group or Men	
Asparagine	0.042				
Creatinine	0.011		0.013		
Glutamic acid	0.006		0.01		
Pipecolic acid	0.009				
Cytidine	0.015		0.016		
Leucic acid			0.015		
D-Galacturonic acid			0.012		
Picolinic acid	0.008		0.045		
2-Pyrrolidinone		0.002	0.016		
Kynurenine	0.004				
Nonadecanoic acid			0.012		
Decanoylcarnitine		0.026			
2-Aminoadipic acid	0.009		0.002		





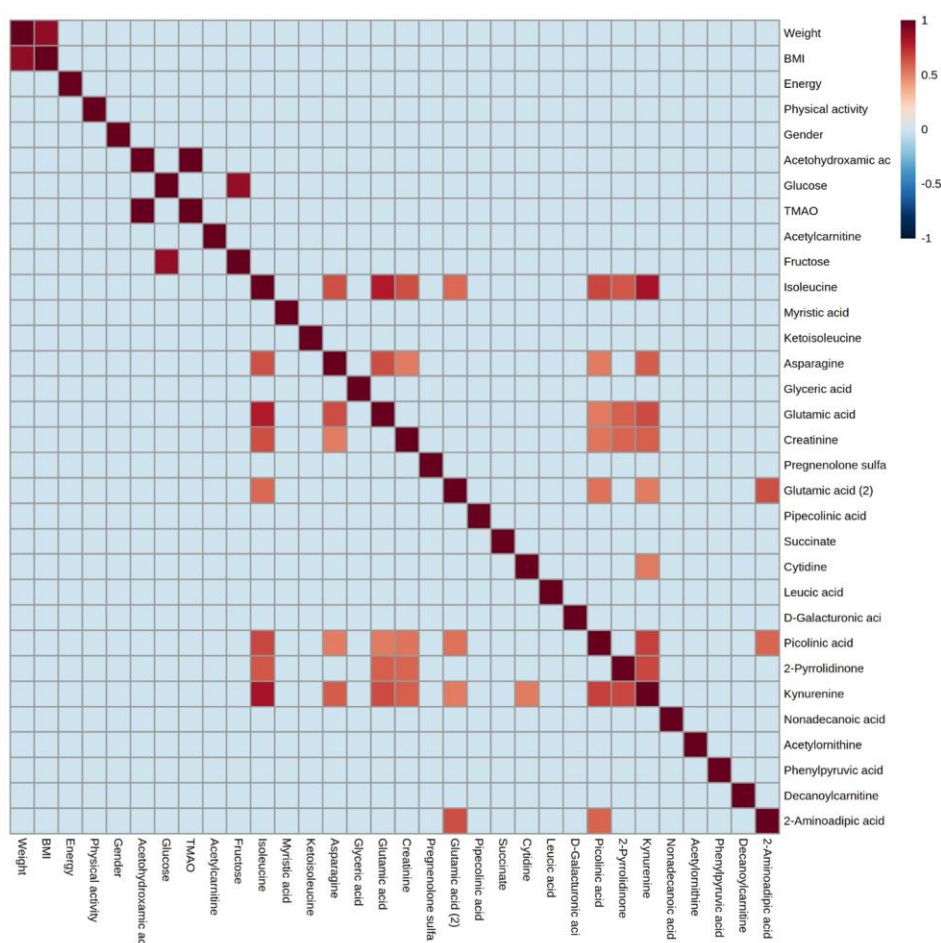




**Figure S2.** Significant metabolites by mean abundances of BMI & sex classification for men and women. BMI groups were stratified into three categories: 1 - normal weight ( $< 25$  BMI), 2 - overweight ( $25 < \text{BMI} < 30$ ), and 3 - obese ( $\text{BMI} > 30$ ). Sex was classified as 1 - men and 2 – women.

**Table S6.** Matrix of correlation analysis between metabolites showing *r* and (*P*-Value).

Metabolites	Acetohydroxamic acid	Fructose	Isoleucine	Picolinic acid	2-Pyrrolidinone	Asparagine
TMAO	0.995 (<0.001)	0.116 (0.320)	0.028 (0.813)	0.095 (0.419)	0.277 (0.016)	-0.077 (0.509)
Glucose	0.150 (0.198)	0.879 (<0.001)	0.117 (0.319)	0.173 (0.137)	0.115 (0.327)	-0.024 (0.841)
Kynurenine	0.063 (0.593)	0.043 (0.713)	0.826 (<0.001)	0.684 (<0.001)	0.669 (<0.001)	0.606 (<0.001)
Glutamic acid	0.082 (0.484)	0.107 (0.359)	0.790 (<0.001)	0.518 (<0.001)	0.601 (<0.001)	0.644 (<0.001)
Creatinine	0.049 (0.678)	0.228 (0.049)	0.647 (<0.001)	0.533 (<0.001)	0.584 (<0.001)	0.513 (<0.001)
2-Aminoadipic acid	-0.045 (0.702)	0.097 (0.409)	0.451 (<0.001)	0.580 (<0.001)	0.313 (0.006)	0.228 (0.049)



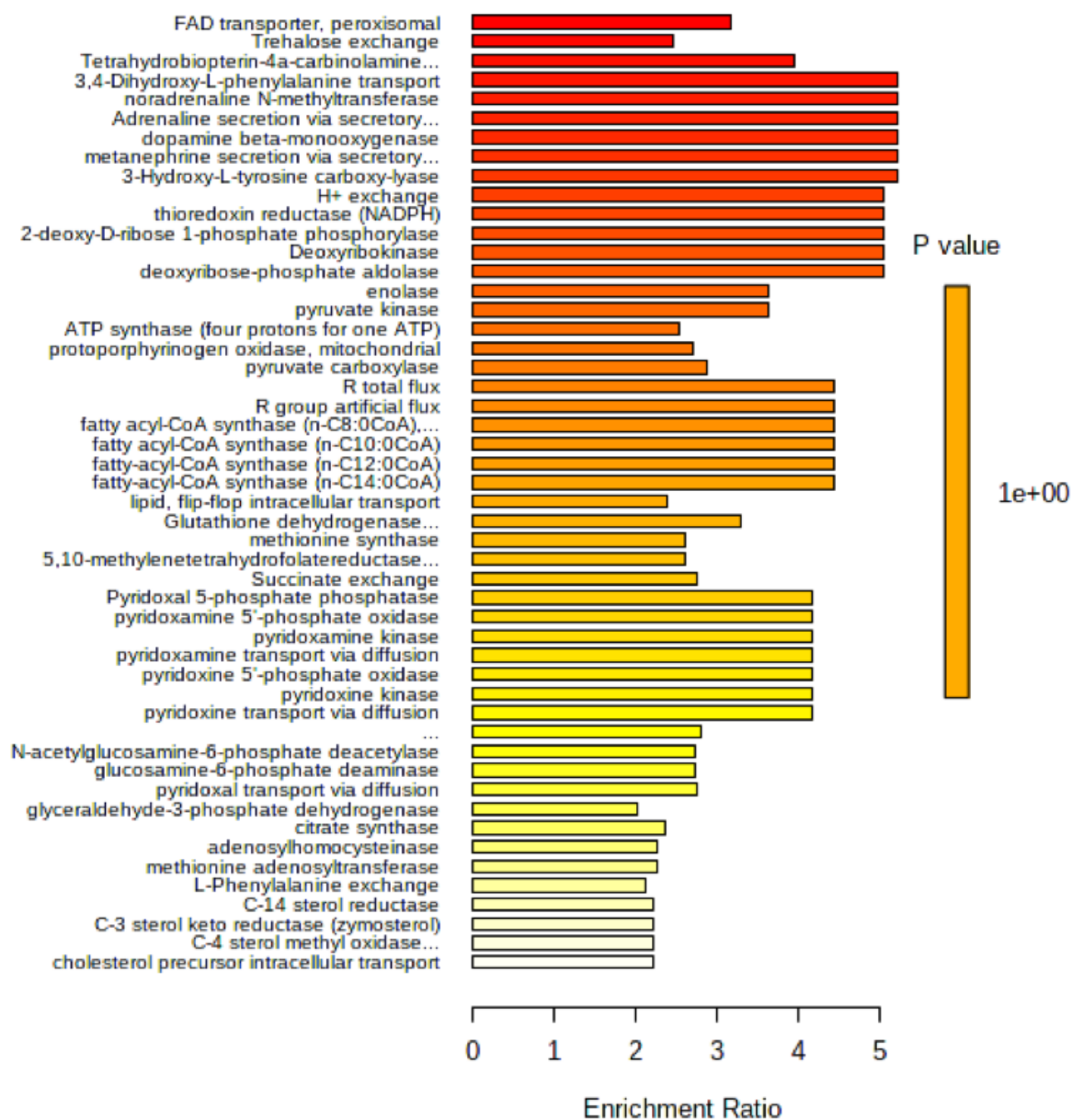
**Figure S3.** Correlation heatmap of significant metabolites and subject demographics performed using Pearson's *r*. All subjects included in the analysis, correlation cutoff = 0.5.

**Table S7.** Pathway Analysis of the impact of sex on the metabolome.

Pathway	Total Metabolites	<i>P</i> -Value	Impact
Lysine degradation	3	<0.001	0.14
Vitamin B <sub>6</sub> metabolism	1	0.012	0.0
Pantothenate and CoA biosynthesis	4	0.013	0.007
Tyrosine metabolism	3	0.018	0.14
Valine, leucine, and isoleucine degradation	5	0.018	0.021
Valine, leucine, and isoleucine biosynthesis	6	0.029	0.0
Pyruvate metabolism	3	0.046	0.292

**Table S8.** Fold changes and *P*-values of significant metabolites between men and women.

Metabolites	Fold Change (Women/men)	<i>P</i> -value
Proline	0.875	0.015
Betaine	0.88	0.045
L-Alloisoleucine	0.771	0.009
Isoleucine	0.747	0.045
Myristic acid	1.156	0.024
2,3-Dihydroxybenzoic acid	1.435	0.022
3-Methyl-2-oxovaleric acid	0.836	0.001
Creatinine	0.829	0.001
Protocatechuic acid	1.436	0.021
Glutamic acid	0.767	0.007
Citraconic acid	0.821	0.001
Creatine	1.185	0.034
9-Octadecynoic acid	1.122	0.042
4-Methyl-2-oxopentanoic acid	0.777	< 0.001
2/3-Aminoisobutyric acid	0.741	0.001
Hypoxanthine	0.763	0.02
2-Hydroxyphenylacetic acid	0.785	< 0.001
Leucic acid	0.744	0.002
Picolinic acid	0.841	0.032
Lauric acid	1.424	< 0.001
Tyrosine	0.828	0.016
3-Phenyllactic acid	0.726	0.001
Phenylpyruvic acid	0.841	0.008
2-Aminoadipic acid	0.689	< 0.001



**Figure S4.** Enrichment Analysis assessing the impact of sex on the metabolome.