

Supplementary Figure Legends

Figure S1: We created 2 enrichment curves, one for [^{13}C]amino-adipic acid (a) and one for [^{15}N]lysine (b) with authentic standards. We ran these along every single batch of samples to ensure the response stayed within the linear range. Figures S1a and S1b are examples of each curve in a typical batch analysis.

Figure S2: An oral glucose tolerance test (OGTT) was performed after 12 hours fast to determine insulin sensitivity. (a) glucose and (b) insulin levels during OGTT. Mann-Whitney test was used to compare between-group comparisons. Statistical significances are indicated as * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$; **** $p \leq 0.0001$.

Figure S3: Insulin infusion decreased lysine and α -AA flux in insulin resistant OW people with PCOS. Parameters were measured at a steady state before insulin infusion (Baseline) and hyperinsulinemic-euglycemic clamp (Insulin) in 18 IR and 12 healthy controls. (a) Lysine flux, and (b) α -AA flux. Two-way repeated measures of ANOVA were performed to identify significantly altered parameters. Multiple comparisons were corrected by FDR method of Benjamini and Hochberg. A P-value < 0.05 is considered as significant. α -AA: α -amino adipic acid, IR: insulin resistance.

Figure S4: Association between insulin sensitivity and concentrations of α -AA and lysine is affected by insulin resistance condition. Correlation between glucose infusion rate (GINF) and lysine concentration at baseline (a), lysine concentration at hyperinsulinemia (b), lysine flux at baseline (c), lysine flux at hyperinsulinemia (d), lysine metabolic clearance rate (MCR) at baseline (e), lysine MCR at hyperinsulinemia (f), α -AA concentration at baseline (g), α -AA concentration at hyperinsulinemia (h), α -AA flux at baseline (i), α -AA flux at hyperinsulinemia (j), α -AA MCR at baseline (k), and α -AA MCR at hyperinsulinemia (l). Spearman correlation analysis was

performed to identify the correlation between the variables. A p-value < 0.05 is considered as significant.

Supplementary Methods:

parameters.

Materials

[α - $^{13}\text{C}_1$]- α -AA powder (99 atom % excess, Sigma Aldrich, Saint Louis, USA) was diluted with 8.4% NaHCO_3 until the solution appeared clear with no visible precipitate. 1mL of NaHCO_3 was used for every 50mg of powder. The solution was further diluted 9x with 0.9% NaCl , and pH was adjusted with 2N HCl until it reached 7.02. The 5mg/mL stock solution was then sterile-filtered by Mayo Clinic Pharmacy, diluted to 1mg/mL, and stored at 4 $^{\circ}\text{C}$. [α - ^{15}N]-Lysine-2HCl (98 atom % excess Cambridge isotope laboratories, Inc. USA #NLM-143-0) stock solution was also prepared by Mayo Clinic Pharmacy.

Analytical methods

Isotope measurements: Plasma samples were prepared for derivatization with modifications (17). Briefly, the plasma sample (50 μl) was acidified using 50 μl of 50% acetic acid for 5 min after adding [$^{13}\text{C}_5$]-lysine and [$^{13}\text{C}_5$]-glutamate as an internal standard (IS) for lysine and as a surrogate IS for α -AA. The mixture was passed through a prewashed AG-50W cation exchange column. The solution was allowed to pass under gravity, and the column was then rinsed twice with water (2 x 5ml). Bound amino acids were eluted with 4 M ammonium hydroxide (3 x 1ml) and evaporated to dryness in a Speed-Vac without heat. Samples were derivatized to their methyl esters with 50 μl of 4 M HCL in methanol at 85 $^{\circ}\text{C}$ for 45 min and dried in a speed-vac without heat. For LC-MS

analysis, 50 μ l of 5% acetonitrile was added to each sample, vortexed, and transferred to autosampler vials.

UPLC Separation was achieved using the Dionex Ultimate 3000 system with a reversed-phase C18 column (high-strength silica 2.1 x 150 mm, 1.8 μ m; Waters) heated to 30⁰C. Mobile phase A was 99% Milli-Q water, 1 % acetonitrile (Fisher Scientific), and 0.1 % formic acid (Fluka). Mobile phase B was 99% acetonitrile, 1 % Milli-Q water with 0.1 % formic acid. Data was acquired with two separate injections to account for very high levels of lysine and significantly low levels of α -AA in derivatized samples. For α -AA analysis, the gradient was as follows: 0-4.5 min, 5-35% B at 0.3 ml/min; 4.5-5 min, 35-95% B at 0.4 ml/min; 5-7 min, 95% B at 0.4 ml/min; 7-7.5 min, 95-5% B at 0.4 ml/min; 7.5-10 min, 5% B at 0.3 ml/min. An injection volume of 4 μ l was used. The UPLC system was connected to the ion source via a diverter valve, which was open for 1.5-4 minutes and then closed until the end of the run. Samples were diluted 4 times using 5 % acetonitrile for lysine analysis, and the gradient was as follows: 0-2.5 min, 5-15% B at 0.3 ml/min; 2.5-3 min, 15-95% B at 0.4 ml/min; 3-7 min, 95% B at 0.4 ml/min; 7-7.5 min, 95-5% B at 0.4 ml/min; 7.5-10 min, 5% B at 0.3 ml/min. The UPLC system was connected to the ion source via a diverter valve, which was open for 0.5-2.5 minutes and then closed until the end of the run. An injection volume of 1 μ l was used for lysine analysis. The HESI ion source was operated at +3.5 kV spray voltage and probe heater temperature of 300⁰C. Sheath, auxiliary, and spare gas were 48, 11, and 1 (au), respectively. The capillary temperature was maintained at 275⁰C.

A high-resolution orbitrap mass spectrometer (Thermo Q Exactive Plus) was used at 70,000 resolution for all analyses. A maximum injection time of 100ms was employed, and an AGC target of 1e⁶ was used for α -AA, whereas an AGC target of 2e⁵ was used for L-lysine. An isolation window width of 4.0 m/z and 1.0 m/z was used for precursor isolation of lysine and α -AA,

respectively. The product ions were collected under high resolution. Precursor-transition pairs corresponding to ^{14}N -lysine (161.12 > 144.1019), ^{15}N -lysine (161.12 > 144.1019), ^{12}C - α -AA (190.12 > 158.0809), ^{13}C - α -AA (191.12 > 159.0842), and ^{15}N - α -AA (191.12 > 159.0782) were measured.

Based on [$^{15}\text{N}_1$]-lysine infusion alone, product ion m/z 159.0784 corresponding to [$^{15}\text{N}_1$]- α -AA was selected for enrichment calculations. Since the mass spectrometer was set at a resolution of 70,000, product ion m/z 159.0844 corresponding to [^{13}C]- α -AA could be distinguished from [^{15}N]- α -AA and was used to calculate [^{15}N] and [^{13}C]- α -AA enrichment.

Important to note that since these data were acquired in a quadrupole-orbitrap under parallel reaction monitoring mode (PRM) that included only 2 ions, 190.12 & 191.12, for ^{12}C [AAA] & [^{13}C]AAA respectively, at 1.0 m/z isolation width, dwell time was not one of the parameters. Instead, we used the following parameters for this data acquisition: resolution at 70K, AGC target of $1\text{e}6$, and Maximum IT of 100 ms to achieve 10-15 points across each isotope peak.

Supplementary Table S1: Metabolomics data

Supplementary Table S1a: (Control)

Group	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control
Time point	baseline	Insulin	baseline	Insulin	baseline	Insulin	baseline	Insulin	baseline	Insulin	baseline	Insulin	baseline	Insulin	baseline	Insulin	baseline	Insulin	baseline	Insulin	baseline	Insulin	baseline	Insulin
Subject	C1	C1	C2	C2	C3	C3	C4	C4	C5	C5	C6	C6	C7	C7	C8	C8	C9	C9	C10	C10	C11	C11	C12	C12
Valine(μM)	262.36	81.44	204.53	102.30	316.56	132.49	258.40	109.22	274.20	117.73	266.19	116.36	285.85	104.33	215.62	118.81	243.99	111.57	268.55	133.82	263.67	107.15	260.44	112.08
Leucine(μM)	143.89	29.44	104.46	35.83	162.38	40.85	148.84	38.22	116.40	44.41	136.84	41.29	144.49	34.15	116.12	41.57	106.36	39.24	105.87	47.37	150.39	37.24	118.42	36.66
Isoleucine(μM)	97.57	14.45	70.59	16.39	106.22	24.02	92.06	16.24	76.04	19.14	84.24	15.27	89.64	15.68	70.88	20.13	60.57	21.26	59.02	22.72	93.67	17.31	73.10	18.28
Phenylalanine(μM)	74.30	30.07	66.08	30.85	70.14	27.99	94.53	37.31	65.88	32.04	79.38	34.89	68.48	26.57	74.47	33.06	69.10	34.92	78.74	40.92	79.35	27.68	72.64	29.35
Tryptophan(μM)	67.12	25.99	72.97	34.43	78.08	27.22	65.22	31.83	79.70	37.36	78.39	39.11	71.63	24.97	72.63	35.96	47.18	23.30	71.94	41.97	82.38	35.14	82.37	39.53
Methionine(μM)	31.21	6.71	0.07	8.80	41.07	10.13	37.84	8.49	21.88	9.30	27.06	8.05	29.75	7.63	13.85	9.09	26.17	11.59	27.49	10.46	39.24	8.01	31.28	8.72
Lysine(μM)	181.61	155.73	154.72	145.20	207.44	202.53	234.11	207.78	132.24	159.33	180.92	187.62	172.14	169.16	99.47	194.81	161.68	223.19	165.13	204.72	231.37	186.36	182.68	215.70
Histidine(μM)	163.98	76.54	107.21	77.33	134.90	93.84	130.76	72.13	135.19	79.78	96.77	68.98	115.59	74.15	79.14	73.24	109.23	71.02	112.56	70.27	123.91	61.67	142.41	84.96
Threonine(μM)	110.53	35.87	102.49	50.02	148.22	67.13	236.74	107.48	106.72	61.67	98.47	47.60	137.39	55.27	71.47	46.19	116.24	73.96	131.33	71.57	150.26	53.91	120.48	54.30
Glycine(μM)	199.70	157.72	270.67	225.30	200.12	198.18	267.61	198.26	228.22	251.34	188.44	218.95	294.36	240.43	347.31	320.82	206.67	237.25	332.98	295.49	196.29	141.18	330.05	327.79
Sarcosine(μM)	12.64	12.95	6.40	5.09	5.60	3.71	6.47	4.90	7.86	5.49	6.55	6.11	6.03	5.17	4.98	5.50	5.75	5.25	6.73	5.04	7.57	5.86	7.15	7.86
Alanine(μM)	286.11	180.59	332.15	231.59	415.73	331.82	408.47	262.77	256.83	186.88	357.68	199.53	306.90	176.52	234.57	249.37	319.76	234.57	382.88	257.09	416.79	240.60	340.54	240.45
beta-Alanine(μM)	6.22	1.75	13.62	2.05	11.10	2.53	11.22	1.93	18.60	1.76	8.52	2.65	8.27	2.25	1.65	2.06	3.74	1.13	7.63	0.64	19.37	1.75	5.30	1.06
Serine(μM)	105.10	53.58	92.65	60.27	110.65	68.21	165.93	86.18	113.44	90.15	82.73	55.68	110.61	58.53	95.49	56.81	100.82	79.18	108.71	66.36	129.33	56.51	116.99	74.08
Arginine(μM)	73.61	30.11	61.70	27.61	91.79	47.01	129.72	61.69	49.35	32.69	76.26	33.78	56.84	26.81	76.49	38.21	47.99	39.49	57.58	38.42	110.75	41.75	60.76	34.07
Ornithine(μM)	45.12	13.69	32.71	13.09	66.24	27.23	62.52	25.93	38.00	18.33	40.74	20.31	45.05	14.29	60.62	24.51	49.75	26.96	52.62	25.28	63.30	23.99	40.33	17.87
Citrulline(μM)	31.67	13.36	25.03	14.62	32.62	20.20	28.96	16.15	29.08	15.00	38.26	20.09	40.07	14.24	40.24	18.08	26.58	13.16	28.58	22.55	32.31	15.75	25.25	16.76
Asparagine(μM)	84.56	38.35	83.73	39.60	112.27	52.88	136.60	49.01	63.19	39.22	79.39	34.93	101.57	42.25	90.74	44.64	115.66	63.85	105.20	61.43	117.02	45.37	84.95	47.89
Aspartic Acid(μM)	3.63	1.79	1.40	1.03	2.05	1.19	3.21	1.68	1.76	1.11	2.58	1.59	1.95	0.69	1.81	0.89	1.75	0.89	1.25	0.70	1.69	0.78	0.90	0.66
Glutamine(μM)	404.64	278.42	447.14	302.32	543.59	427.07	573.00	397.02	370.01	285.44	372.57	302.28	387.20	307.31	382.97	334.04	435.43	431.03	525.21	387.13	490.69	308.09	445.05	392.60
Glutamic Acid(μM)	34.12	25.45	15.21	16.93	22.45	26.80	46.24	29.43	25.61	23.10	46.29	30.95	37.48	21.95	47.90	31.11	43.70	40.89	25.74	30.73	33.88	25.50	23.85	24.32
Tyrosine(μM)	59.68	15.93	54.99	20.03	87.26	24.91	80.13	22.57	71.22	28.46	76.05	29.45	74.78	16.72	65.09	25.88	55.84	23.83	70.67	31.24	98.68	28.48	51.51	19.63
Cysteine(μM)	8.24	5.10	10.23	10.80	12.37	17.41	18.27	11.99	15.83	15.31	11.28	11.84	8.74	17.34	13.98	25.43	21.52	19.42	17.63	23.96	18.57	17.66	15.00	13.05
Homocysteine(μM)	0.87	0.80	0.68	0.53	0.49	0.57	1.02	1.01	0.78	0.87	1.52	1.55	0.91	0.85	1.04	1.12	1.56	1.07	1.58	1.82	1.56	1.55	0.78	1.17
Cystathionine 3(μM)	0.61	0.27	0.41	0.25	0.48	0.25	0.36	0.21	0.40	0.23	0.41	0.23	0.27	0.23	0.24	0.25	0.78	0.33	0.45	0.25	0.68	0.25	0.32	0.20
alpha-Amino adipic acid(μM)	1.85	1.13	1.34	0.83	1.84	0.93	1.28	0.85	1.20	0.72	2.27	1.16	1.43	0.94	0.85	0.89	1.67	0.86	1.72	1.11	1.40	0.96	1.23	1.09
Hydroxylysine 2(μM)	0.72	0.43	0.97	0.57	0.61	0.41	0.61	0.37	0.67	0.50	0.65	0.42	0.60	0.57	0.38	0.48	0.60	0.49	0.62	0.50	0.89	0.43	0.51	0.43
1-Methylhistidine(μM)	47.52	11.36	28.46	8.75	55.97	18.32	29.56	8.54	53.73	11.51	24.23	6.57	10.21	2.58	0.62	0.57	6.62	2.26	4.74	1.88	19.41	4.85	29.29	7.19
3-Methylhistidine(μM)	11.54	5.11	6.89	4.30	7.80	4.57	4.95	2.38	11.47	4.15	7.23	3.49	6.73	3.26	3.67	3.53	4.73	2.58	7.04	4.42	6.77	4.51	4.57	2.47
Proline(μM)	231.07	91.24	198.28	102.39	334.20	150.10	303.30	118.99	165.96	80.34	216.72	69.42	254.24	78.04	168.28	92.62	232.74	104.25	235.34	99.68	276.56	77.15	179.55	73.02
Hydroxyproline(μM)	12.10	6.15	16.20	9.90	16.31	9.67	16.28	8.76	19.97	10.66	14.58	7.55	17.13	7.40	11.10	7.16	10.83	7.72	13.91	6.67	14.58	6.83	12.00	7.35
alpha-Amino-N-butyric acid(μM)	17.02	11.37	13.53	9.84	23.58	21.51	25.83	16.94	21.19	16.19	15.44	9.72	13.44	12.78	22.73	16.74	11.93	10.08	14.13	14.52	23.47	15.03	21.42	20.24
beta-Aminoisobutyric acid(μM)	1.12	0.96	1.74	1.35	1.60	1.52	0.91	0.81	1.06	0.90	1.50	1.48	2.41	2.49	2.01	1.88	1.52	1.42	0.93	0.86	2.18	1.87	0.79	0.75
gamma-Amino-N-butyric acid(μM)	0.19	0.16	0.21	0.18	0.21	0.17	0.17	0.16	0.20	0.17	0.19	0.18	0.20	0.18	0.18	0.19	0.17	0.15	0.19	0.16	0.21	0.18	0.18	0.16
Ethanolamine(μM)	3.86	3.85	5.08	4.52	5.09	5.16	4.00	3.97	6.45	5.60	4.16	4.55	3.84	3.91	3.94	4.75	3.18	3.37	5.08	4.68	5.43	5.45	4.42	4.21
Phosphoethanolamine(μM)	2.38	1.11	1.97	1.00	2.43	0.70	1.83	0.78	2.09	0.75	2.25	1.40	1.79	1.24	1.69	2.12	1.67	0.90	2.63	0.87	2.70	1.31	1.43	0.86

Supplementary Table S1b: (Insulin Resistant-IR)

Group	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR
Time point	baseline	Insulin n	baseline	Insulin n	baseline	Insulin n	baseline	Insulin n	baseline	Insulin n	baseline	Insulin n	baseline	Insulin n	baseline	Insulin n	baseline	Insulin n	baseline	Insulin n	baseline	Insulin n	baseline	Insulin n	baseline	Insulin n	baseline	Insulin n	baseline	Insulin n	baseline	Insulin n	baseline	Insulin n	baseline	Insulin n
Subject	IR1	IR1	IR2	IR2	IR3	IR3	IR4	IR4	IR5	IR5	IR6	IR6	IR7	IR7	IR8	IR8	IR9	IR9	IR10	IR10	IR11	IR11	IR12	IR12	IR13	IR13	IR14	IR14	IR15	IR15	IR16	IR16	IR17	IR17	IR18	IR18
Valine(μM)	348.09	167.0 2	266.4 3	116.9 4	249.5 1	171.1 6	291. 08	164. 06	339. 17	195.9 9	258. 90	14 1.8 1	232.9 3	132.6 5	293. 55	151.7 8	285. 45	173.3 6	31 2.3 9	216. 83	398.83	151.4 0	265.4 9	198.0 5	366.5 1	173.86	286.31	204.57	306.9 6	189.69	313.17	127.35	476.84	263.53	338.1 7	175.92
Leucine(μM)	197.93	71.88	138.4 7	42.37	107.9 5	66.59	143. 90	60.4 3	151. 49	82.02	158. 90	56 70	126.0 3	51.12	168. 05	63.68	147. 22	68.70	15 5.8 5	98.1 5	227.97	41.01	111.6 5	83.34	153.7 9	58.77	136.71	87.38	185.3 3	80.56	159.39	41.89	263.64	100.28	177.0 1	57.83
Isoleucine(μM)	121.64	42.28	83.88	16.74	68.42	31.43	94.3 6	25.6 2	86.7 5	35.34	73.8 6	21. 54	77.38	19.46	105. 02	33.27 1	90.1 1	32.39	93. 62	43.9 3	133.38	15.72	62.49	36.81	99.52	28.98	84.71	41.43	114.7 3	40.67	103.18	19.98	167.52	44.24	114.1 2	30.16
Phenylalanine(μM)	95.65	48.47	99.78	50.18	52.60	29.50	71.9 3	36.8 0	61.6 6	40.23	74.4 3	38 27	71.91	31.10	77.2 7	38.19	90.2 4	48.99	80 99	68.0 2	88.02	31.73	62.37	47.77	64.64	33.99	63.13	41.94	71.78	45.64	71.28	30.80	86.67	50.33	76.50	37.10
Tryptophan(μM)	99.23	48.89	50.43	77.23	63.88	39.27	74.9 6	41.3 1	82.8 9	43.37	73.4 9	45. 29	56.77	30.11	88.4 0	45.40	82.1 2	49.43	99. 14	50.9 0	88.14	37.19	71.77	44.03	78.03	41.21	71.12	49.87	83.40	54.71	90.48	38.46	82.07	45.91	84.36	37.98
Methionine(μM)	36.17	17.83	22.80	8.08	24.90	11.78	27.3 5	12.2 2	26.3 9	14.25	32.1 9	11 59	25.68	10.48	30.5 1	12.29	31.6 8	14.20	25. 32	14.5 0	43.46	9.84	20.05	14.46	18.52	8.28	29.08	17.80	25.77	12.30	37.18	9.97	34.20	14.44	30.72	11.01
Lysine(μM)	241.73	238.3 8	173.3 6	187.6 8	186.3 9	272.1 1	236. 95	261. 21	243. 34	316.4 8	244. 26	24 0.5 6	138.4 4	224.7 1	272. 26	252.5 9	233. 32	286.5 4	20 2.9 9	273. 94	274.92	211.6 8	168.6 0	266.2 4	170.7 9	207.20	239.87	323.90	252.0 1	286.51	219.93	249.29	244.48	320.21	249.4 0	230.92
Histidine(μM)	113.53	73.19	141.4 3	71.00	108.5 7	97.25	118. 23	100. 38	109. 38	80.20	134. 56	85. 71	99.91	89.54	107. 20	66.37	117. 57	90.66	11 4.3 7	77.0 3	144.82	69.94	99.74	80.77	100.4 9	77.24	95.01	76.20	105.8 2	89.22	125.44	81.48	112.43	126.40	113.4 3	61.31
Threonine(μM)	125.93	73.43	100.5 9	48.00	132.2 3	79.00	135. 42	83.3 2	150. 28	84.51	133. 57	69 51	127.2 5	81.50	126. 00	66.73	159. 41	101.4 2	14 0.1 1	105. 86	142.71	55.56	93.89	70.53	93.93	51.31	151.61	107.46	124.1 1	81.30	177.42	80.62	129.32	87.87	176.2 5	105.75
Glycine(μM)	166.52	224.7 4	269.6 4	245.3 0	137.7 7	137.7 3	246. 44	265. 06	148. 94	135.5 6	180. 01	14 4.5 2	230.3 8	232.6 0	152. 66	145.5 1	192. 87	216.9 0	8.0 8.0	223. 43	221.07	183.3 7	161.1 2	173.7 4	188.3 8	197.97	116.52	115.76	132.5 5	160.06	183.86	185.89	104.05	134.07	207.1 4	210.50
Sarcosine(μM)	7.52	13.79	7.32	6.54	7.95	7.03	5.81	6.12	6.28	5.33	6.48	6.6 7	9.24	11.48	4.17	3.14	5.65	4.39	5.2 5	0.64	6.65	7.26	5.61	6.58	6.90	6.92	5.99	7.34	13.12	13.84	8.82	9.62	10.53	7.08	11.25	10.45
Alanine(μM)	373.90	308.7 3	278.2 1	246.2 0	507.0 1	335.0 9	437. 57	271. 36	357. 86	235.0 9	392. 79	26 6.5 3	459.0 8	305.9 3	370. 27	217.0 9	429. 3	303.9 3	44 3.1 3	320. 47	476.86	270.9 0	297.8 8	242.2 8	287.8 1	205.79	573.99	325.88	386.2 6	256.51	422.88	254.34	434.36	313.14	431.5 6	239.19
beta-Alanine(μM)	15.63	7.61	5.60	2.02	13.02	1.95	9.67	1.64	11.5 8	1.70	8.96	1.7 9	1.73	1.48	34.9 8	3.10	7	3.17	8.4 7	2.93	12.44	1.60	8.20	2.21	15.01	1.88	6.88	1.71	15.71	2.47	35.83	1.42	19.00	1.83	12.69	2.15
Serine(μM)	84.55	67.81	110.8 3	63.22	83.04	68.05	97.8 6	81.8 3	74.3 7	64.89	85.1 8	50 48	100.0 1	61.96	95.5 0	62.43	80.5 5	58.17	95 35	125. 70	126.10	58.49	87.93	78.34	73.14	59.40	90.56	78.18	73.88	63.82	126.72	83.35	65.79	63.08	79.76	58.74
Arginine(μM)	93.61	99.71	63.68	29.26	50.17	42.36	106. 42	15.8 1	86.3 0	51.46	90.3 9	49. 66	74.52	52.14	105. 99	51.05	94.8 5	65.68	75. 66	50.3 7	142.99	51.85	60.89	54.35	56.48	30.93	77.62	49.41	104.6 6	59.64	90.19	44.56	96.36	62.69	114.5 9	53.33
Ornithine(μM)	68.14	33.38	53.02	18.93	36.83	22.19	55.8 3	29.8 9	56.7 9	29.81	75.4 3	27. 36	61.83	33.63	79.3 8	32.93	74.2 5	42.60	61. 26	64.2 8	64.06	21.04	43.21	28.55	54.90	23.95	31.22	18.66	148.8 2	83.43	77.82	28.94	66.26	42.84	66.63	32.98
Citrulline(μM)	26.56	16.12	26.84	9.27	5.88	8.72	36.0 0	16.6 1	38.8 4	22.61	39.5 4	19 83	11.48	21.62	28.1 4	16.63	29.4 3	24.31	26 82	16.2 3	34.37	12.82	30.41	22.31	26.76	16.85	19.56	13.89	26.51	19.15	34.28	16.98	28.52	21.02	36.61	24.21
Asparagine(μM)	70.77	46.14	99.21	34.86	91.89	50.32	85.4 6	47.3 3	91.3 9	55.77	98.9 3	47. 44	95.25	58.83	80.1 3	43.63	89.7 5	54.05	74. 64	61.4 5	112.90	44.97	76.17	56.36	75.82	48.19	102.73	65.57	58.79	44.50	112.78	54.52	66.32	48.96	89.93	48.56
Aspartic Acid(μM)	3.38	2.55	2.18	0.98	2.78	1.95	1.61	1.36	2.02	1.66	3.14	1.8 7	1.76	1.18	4.79	2.53	2.34	1.60	2.3 9	19.4 5	2.28	0.61	1.75	1.29	1.99	1.16	2.35	1.70	4.23	2.34	2.24	0.95	4.38	3.34	3.45	1.88
Glutamine(μM)	435.16	385.8 3	402.5 0	298.2 6	403.5 8	379.2 0	435. 42	345. 14	393. 42	322.1 6	450. 89	32 2.3 2	451.2 9	395.9 4	419. 78	304.0 4	451. 82	395.4 9	33 5.2 4	352. 53	482.14	354.7 7	379.7 0	384.4 2	333.6 7	293.02	325.66	305.28	346.5 0	341.54	561.75	413.35	438.46	409.53	448.5 0	358.03
Glutamic Acid(μM)	87.33	65.30	52.62	26.19	47.17	58.24	36.8 1	45.9 2	47.7 7	63.71	46.6 1	30. 08	32.43	27.44	71.0 7	56.97	49.7 6	38.82	75. 05	110. 87	63.70	27.33	60.59	49.84	51.15	42.79	85.68	54.45	80.17	73.88	33.05	28.14	84.93	68.85	60.15	48.79
Tyrosine(μM)	115.19	49.76	64.73	26.44	53.44	27.15	91.5 2	46.2 9	71.9 1	38.61	73.2 0	30 80	67.51	26.94	83.8 2	35.98	89.2 3	45.76	87. 97	55.2 9	99.13	25.64	58.13	40.14	64.83	29.68	98.34	64.36	96.38	49.75	85.52	28.78	128.90	56.21	110.3 3	42.94
Cysteine(μM)	23.94	20.22	19.42	10.92	13.35	9.31	36.5 4	14.7 5	16.1 6	22.63	9.07 10	72	19.80	18.83	20.4 5	22.68	21.1 9	24.01	21. 95	28.8 3	27.51	17.66	18.87	19.64	15.89	20.61	20.45	19.30	20.59	25.55	15.74	19.62	23.55	25.45	11.17	12.53
Homocysteine(μM)	0.80	0.80	0.70	0.52	0.60	0.67	0.57	0.74	0.57	1.00	1.30	0.8 1	1.18	1.37	1.50	1.57	1.68	1.63	0.2 4	0.03	0.78	1.17	0.98	1.69	1.71	1.93	1.29	2.03	1.62	1.95	1.68	1.19	0.53	0.26	2.02	2.38

Cystathionine 2[μM]	0.75	0.31	0.42	0.24	0.28	0.22	0.35	0.22	0.69	0.37	0.36	0.2 3	0.35	0.24	0.47	0.25	0.43	0.27	0.3 9	0.24	0.49	0.21	0.31	0.23	0.88	0.29	0.28	0.21	0.54	0.27	0.55	0.24	1.61	0.35	0.37	0.21
alpha- Aminoadipic- acid[μM]	3.20	1.29	1.38	0.76	1.40	1.24	1.71	1.01	1.77	1.13	1.53	1.1 5	0.80	0.71	2.38	1.17	1.67	1.40	2.7 4	1.57	2.60	1.12	1.59	1.30	2.03	1.18	2.29	1.92	2.73	1.63	2.10	1.00	4.36	1.50	2.58	1.09
Hydroxylysine 2[μM]	0.59	0.52	1.00	0.47	0.64	0.55	0.49	0.38	0.54	0.47	0.65	0.4 2	0.39	0.37	0.86	0.51	0.65	0.53	0.8 8	0.83	0.72	0.43	1.18	1.02	0.72	0.67	0.65	0.50	0.78	0.65	0.60	0.43	1.48	0.92	0.83	0.52
D- Methylhistidine[μ M]	40.64	6.36	27.92	6.66	34.05	13.33	26.8 0	8.63	61.8 5	14.10	37.2 6	8.2 5	1.54	1.48	53.3 3	12.94	66.8 6	19.80	37. 78	8.18	28.99	10.13	40.67	11.61	25.03	6.25	30.22	6.36	74.52	22.77	56.26	15.19	76.54	23.37	43.70	9.31
D- Methylhistidine[μ M]	5.68	3.28	8.07	3.42	4.94	3.58	5.80	3.79	9.40	4.85	6.05	2.9 7	3.46	3.45	6.25	3.13	9.37	6.25	9.7 3	3.72	12.29	4.22	7.35	4.49	6.56	3.71	6.00	3.41	9.66	6.79	7.30	3.86	11.49	7.90	8.28	3.46
Proline[μM]	301.35	120.7 1	300.1 2	116.8 4	281.4 8	151.1 5	244. 03	98.8 4	194. 13	104.1 8	247. 17	95. 12	338.1 2	148.4 9	227. 90	93.82	283. 74	129.4 8	23 4.5 76	110. 76	279.01	92.67	128.2 3	92.17	175.6 8	85.05	214.34	105.82	261.6 4	139.64	310.25	126.37	435.07	188.59	350.9 5	166.34
Hydroxyproline[μ M]	12.13	8.37	15.61	6.70	11.78	6.01	13.5 7	5.72	16.4 4	7.63	14.5 1	7.4 3	14.53	10.33	15.1 9	7.15	17.8 5	10.83	15. 87	7.41	14.82	8.13	14.19	8.56	10.65	5.90	14.61	9.48	16.64	10.81	15.90	8.38	12.82	10.09	18.57	9.58
alpha-Amino-N- butyric-acid[μM]	30.72	25.51	12.79	11.67	26.33	24.18	30.6 5	23.6 9	20.9 8	20.31	21.8 7	18. 39	9.73	7.26	34.4 6	22.49	29.6 5	26.38	22. 73	23.2 5	33.03	17.31	28.67	30.75	14.15	14.78	35.77	25.89	24.52	23.88	21.64	17.45	30.67	24.56	21.64	20.49
beta- Aminoisobutyric- acid[μM]	1.15	1.37	1.19	1.16	0.88	1.07	2.30	2.29	1.48	1.58	1.10	1.1 0	1.48	1.78	2.70	2.68	1.28	1.65	0.6 8	0.58	1.11	0.83	2.36	2.55	1.09	1.15	0.86	0.94	0.84	0.50	0.80	0.71	0.99	1.09	1.09	0.82
gamma-Amino-N- butyric-acid[μM]	0.16	0.17	0.19	0.17	0.18	0.15	0.18	0.17	0.19	0.17	0.19	0.1 6	0.15	0.15	0.21	0.19	0.18	0.18	0.1 9	0.85	0.20	0.16	0.20	0.19	0.19	0.16	0.16	0.18	0.19	0.17	0.19	0.16	0.20	0.19	0.20	0.17
Ethanolamine[μM]	5.24	5.99	4.20	6.03	4.45	3.93	6.54	6.03	5.87	4.54	4.38	4.3 0	4.48	4.24	4.63	4.06	5.09	5.95	6.2 6	10.2 4	5.10	5.19	4.28	4.44	4.65	4.66	5.37	6.10	4.32	4.29	4.74	4.69	5.03	4.98	4.92	4.45
Phosphoethanolam ine[μM]	1.80	1.21	1.16	1.08	1.54	0.68	1.41	0.73	1.94	1.10	2.00	1.1 8	1.58	0.75	2.05	0.73	1.78	1.22	3.6 5	1.90	5.14	1.13	1.94	1.26	2.54	1.21	2.85	1.71	1.81	1.12	2.73	0.90	2.67	1.27	3.66	0.84