

**Supplemental Table S1.** Individual amino acids summed for analysis by transport system and essential groups.

System	Amino Acids Included
System A	Alanine, serine, glutamine
System Br	Valine, leucine, isoleucine
System Bo	Phenylalanine, tyrosine, tryptophan, valine, leucine, isoleucine
System N	Histidine, aspartic acid, glutamine
Cationic	Lysine, ornithine
Anion	Aspartic acid, glutamic acid
Essential	Valine, leucine, isoleucine, threonine, methionine, phenylalanine, lysine, histidine

**Supplemental Table S2.** Individual amino acids in maternal plasma in the fall replicate.

Amino Acid (μmol/L)	ADQ-CON	RES-CON	ADQ-MEL	RES-MEL	<i>P</i> value		
					NUT	TRT	NUT*TRT
Alanine	186.58 ± 15.10 <sup>b</sup>	345.87 ± 63.03 <sup>a</sup>	235.96 ± 42.49 <sup>a</sup>	188.55 ± 11.22 <sup>a</sup>	-	-	<b>0.05</b>
Sarcosine	6.97 ± 0.28 <sup>c</sup>	8.82 ± 0.62 <sup>a</sup>	7.73 ± 0.40 <sup>abc</sup>	7.30 ± 0.26 <sup>b</sup>	-	-	<b>0.01</b>
Glycine	328.15 ± 41.74	324.81 ± 18.66	293.50 ± 13.98	315.74 ± 35.45	0.19	0.38	0.83
α-Aminobutyric acid	14.38 ± 1.54 <sup>b</sup>	25.04 ± 3.88 <sup>a</sup>	17.71 ± 1.56 <sup>ab</sup>	17.15 ± 2.14 <sup>ab</sup>	-	-	<b>0.02</b>
Valine	227.66 ± 12.59	201.01 ± 12.59	254.09 ± 12.59	238.16 ± 11.74	0.10	<b>0.02</b>	0.67
β-Aminoisobutyric acid	7.46 ± 0.18	9.81 ± 1.20	7.84 ± 0.43	7.36 ± 0.33	0.99	0.28	0.14
Leucine	123.56 ± 7.76	103.89 ± 7.76	125.95 ± 7.76	127.14 ± 7.24	0.24	0.11	0.18
Isoleucine	88.03 ± 7.54	68.52 ± 7.54	90.35 ± 7.54	89.50 ± 7.03	0.18	0.13	0.22
Threonine	44.12 ± 3.84	42.42 ± 3.79	54.96 ± 3.79	45.05 ± 3.59	0.14	0.09	0.28
Serine	43.57 ± 4.68	58.08 ± 4.62	51.60 ± 4.62	48.84 ± 4.38	0.21	0.90	0.07
Proline	60.81 ± 4.77	88.85 ± 9.44	70.96 ± 9.46	66.06 ± 5.30	0.11	0.75	0.06
Asparagine	20.59 ± 1.71	26.20 ± 1.74	23.89 ± 1.76	24.19 ± 1.59	0.09	0.71	0.14
Thiaproline	2.50 ± 0.42	2.11 ± 0.55	1.25 ± 0.59	1.87 ± 0.55	0.79	0.14	0.79
Aspartic acid	10.12 ± 0.22 <sup>b</sup>	19.54 ± 3.82 <sup>a</sup>	12.20 ± 1.05 <sup>a</sup>	10.68 ± 0.58 <sup>ab</sup>	-	-	<b>&lt;0.01</b>
Methionine	18.23 ± 0.96	19.48 ± 0.97	21.47 ± 0.97	19.70 ± 0.89	0.78	0.08	0.13
4-Hydroxyproline	21.01 ± 0.95	55.56 ± 13.23	29.90 ± 10.75	21.76 ± 1.14	<b>0.04</b>	0.36	0.63
Glutamic acid	66.60 ± 2.43 <sup>c</sup>	224.84 ± 59.45 <sup>a</sup>	95.48 ± 16.06 <sup>ab</sup>	79.33 ± 11.68 <sup>bc</sup>	-	-	<b>&lt;0.01</b>
Phenylalanine	45.85 ± 1.78	60.94 ± 6.81	50.37 ± 3.83	48.87 ± 2.51	0.14	0.95	0.18
α-Aminoadipic acid	10.16 ± 0.28 <sup>b</sup>	12.31 ± 0.56 <sup>a</sup>	10.77 ± 0.54 <sup>ab</sup>	10.32 ± 1.99 <sup>b</sup>	-	-	<b>0.03</b>
Glutamine	280.27 ± 33.54 <sup>b</sup>	635.50 ± 110.09 <sup>b</sup>	398.92 ± 78.03 <sup>ab</sup>	278.39 ± 59.15 <sup>b</sup>	-	-	<b>&lt;0.01</b>
Ornithine	48.63 ± 4.56	53.54 ± 4.56	58.42 ± 4.56	48.82 ± 4.26	0.60	0.57	0.12
Glycine-proline	0.03 ± 0.02	1.90 ± 0.73	0.84 ± 0.83	0.13 ± 0.09	0.17	0.22	0.09
Lysine	60.34 ± 5.75 <sup>b</sup>	75.75 ± 5.75 <sup>a</sup>	71.36 ± 5.75 <sup>ab</sup>	57.50 ± 5.36 <sup>b</sup>	-	-	<b>0.02</b>
Histidine	41.18 ± 5.58	48.50 ± 5.58	47.02 ± 5.58	36.37 ± 5.20	0.76	0.57	0.11
Hydroxylysine	8.84 ± 0.11 <sup>ab</sup>	9.29 ± 0.20 <sup>a</sup>	9.08 ± 0.16 <sup>ab</sup>	7.76 ± 1.13 <sup>b</sup>	-	-	<b>0.02</b>
Tyrosine	40.75 ± 3.98 <sup>b</sup>	52.05 ± 3.98 <sup>a</sup>	49.87 ± 3.98 <sup>ab</sup>	41.88 ± 3.71 <sup>ab</sup>	-	-	<b>0.02</b>
Proline-hydroxyproline	19.12 ± 0.38	36.92 ± 7.55	26.39 ± 7.58	19.75 ± 0.39	<b>0.02</b>	0.78	0.54
Tryptophan	33.56 ± 2.58	35.51 ± 2.58	35.30 ± 2.58	29.07 ± 2.41	0.41	0.37	0.12
Cystathionine	0.12 ± 0.12 <sup>ab</sup>	4.04 ± 2.02 <sup>a</sup>	0.92 ± 0.77 <sup>ab</sup>	0.00 ± 0.00 <sup>b</sup>	-	-	<b>0.04</b>
Cystine	16.24 ± 1.12 <sup>bc</sup>	19.29 ± 1.44 <sup>ab</sup>	19.03 ± 1.03 <sup>a</sup>	11.40 ± 2.52 <sup>c</sup>	-	-	<b>&lt;0.01</b>

Data are presented as means ± standard error. Bolded *P* values are significant at  $P \leq 0.05$ . When there is a significant interaction, the *P* values for main effects of nutrition and treatment are not shown and replaced with a dash (-). Superscripts(a,b,c) denotes differences at  $P \leq 0.05$ . Concentrations are expressed in μmol/L. Experimental units: ADQ-CON, n = 6; RES-CON, n = 6; ADQ-MEL, n = 6; RES-MEL n = 7. Abbreviations: NUT, nutrition; TRT, treatment; NUT\*TRT, nutrition by treatment interaction; ADQ-CON, adequately fed control; RES-CON, restricted fed control; ADQ-MEL, adequately fed melatonin supplemented; RES-MEL, restricted fed melatonin supplemented.

**Supplemental Table S3.** Individual amino acids in fetal plasma in the fall replicate.

Amino Acid (μmol/L)									<i>P</i> value		
	ADQ-CON		RES-CON		ADQ-MEL		RES-MEL		NUT	TRT	NUT*TRT
Alanine	454.89 ±	40.12	453.04 ±	40.12	459.44 ±	40.12	432.80 ±	37.43	0.72	0.84	0.76
Sarcosine	9.91 ±	0.73	9.77 ±	0.54	10.13 ±	0.89	9.25 ±	0.44	0.53	0.56	0.93
Glycine	328.83 ±	18.73	300.82 ±	18.89	291.32 ±	19.72	325.88 ±	17.94	0.87	0.74	0.10
α-Aminobutyric acid	28.33 ±	3.70	32.68 ±	3.70	30.43 ±	3.70	28.39 ±	3.45	0.75	0.77	0.39
Valine	210.29 ±	18.80	211.51 ±	18.96	200.31 ±	19.79	218.02 ±	18.01	0.65	0.93	0.66
β-Aminoisobutyric acid	11.78 ±	0.87	10.38 ±	0.87	10.59 ±	0.87	11.63 ±	0.81	0.84	0.97	0.17
Leucine	90.21 ±	6.67	84.93 ±	6.85	86.34 ±	7.13	84.44 ±	6.31	0.62	0.75	0.80
Isoleucine	57.33 ±	4.76	57.41 ±	4.89	54.63 ±	5.08	53.75 ±	4.50	0.94	0.51	0.92
Threonine	49.72 ±	3.29	37.97 ±	3.78	51.83 ±	5.11	35.01 ±	5.64	0.18	0.71	0.20
Serine	75.12 ±	7.65	71.53 ±	8.26	77.74 ±	8.13	75.95 ±	7.20	0.75	0.65	0.91
Proline	103.89 ±	6.18	105.37 ±	6.35	101.53 ±	6.61	100.25 ±	5.85	0.99	0.56	0.82
Asparagine	24.50 ±	1.25	25.76 ±	1.25	24.27 ±	1.25	23.36 ±	1.17	0.89	0.30	0.39
Thiaproline	1.26 ±	0.59	2.08 ±	0.54	1.25 ±	0.59	1.82 ±	0.53	0.59	0.98	0.99
Aspartic acid	23.81 ±	1.79	18.51 ±	2.31	26.00 ±	3.01	24.56 ±	2.36	0.23	0.15	0.66
Methionine	20.52 ±	1.41	19.69 ±	1.42	23.14 ±	1.43	18.28 ±	1.32	<b>0.05</b>	0.67	0.17
4-Hydroxyproline	77.53 ±	6.31	78.69 ±	6.31	83.48 ±	6.31	75.15 ±	5.88	0.57	0.85	0.45
Glutamic acid	306.37 ±	38.63	262.23 ±	39.69	362.37 ±	41.29	377.23 ±	36.54	0.72	<b>0.04</b>	0.45
Phenylalanine	81.70 ±	5.30	78.67 ±	5.72	70.03 ±	5.63	81.53 ±	4.99	0.47	0.41	0.19
α-Aminoadipic acid	13.31 ±	0.38	12.90 ±	0.43	13.26 ±	0.46	14.32 ±	1.30	0.44	0.85	0.36
Glutamine	696.38 ±	121.28	690.72 ±	121.28	808.77 ±	121.28	730.39 ±	113.17	0.73	0.53	0.76
Ornithine	55.61 ±	6.43	58.69 ±	6.54	69.40 ±	6.61	62.15 ±	5.97	0.74	0.19	0.44
Glycine-proline	3.85 ±	0.72	2.32 ±	0.74	3.70 ±	0.77	3.00 ±	0.68	0.16	0.72	0.57
Lysine	78.50 ±	7.52	73.75 ±	7.52	81.35 ±	7.52	67.21 ±	7.02	0.21	0.81	0.53
Histidine	49.63 ±	6.48	35.90 ±	6.48	50.42 ±	6.48	38.65 ±	6.05	0.06	0.78	0.88
Hydroxylysine	9.81 ±	0.22	9.75 ±	0.26	10.02 ±	0.24	9.94 ±	0.21	0.83	0.32	0.96
Tyrosine	63.30 ±	5.73	63.25 ±	6.18	60.70 ±	6.09	59.43 ±	5.39	0.92	0.58	0.92
Proline-hydroxyproline	55.84 ±	5.60	45.04 ±	5.60	58.51 ±	5.60	47.61 ±	5.23	0.06	0.64	0.99
Tryptophan	42.94 ±	3.94	38.64 ±	3.94	41.63 ±	3.94	32.47 ±	3.67	0.09	0.35	0.54
Cystathionine	6.81 ±	1.92	5.59 ±	1.92	8.58 ±	1.92	7.59 ±	1.79	0.56	0.33	0.95
Cystine	18.72 ±	0.48	17.92 ±	1.29	20.20 ±	1.22	15.78 ±	2.37	0.13	0.71	0.32

Data are presented as means ± standard error. Bolded *P* values are significant at  $P \leq 0.05$ . When there is a significant interaction, the *P* values for main effects of nutrition and treatment are not shown and replaced with a dash (-). Superscripts(a,b,c) denotes differences at  $P \leq 0.05$ . Concentrations are expressed in μmol/L. Experimental units: ADQ-CON, n = 6; RES-CON, n = 6; ADQ-MEL, n = 6; RES-MEL n = 7. Abbreviations: NUT, nutrition; TRT, treatment; NUT\*TRT, nutrition by treatment interaction; ADQ-CON, adequately fed control; RES-CON, restricted fed control; ADQ-MEL, adequately fed melatonin supplemented; RES-MEL, restricted fed melatonin supplemented.

**Supplemental Table S4.** Individual amino acids in amnion in the fall replicate.

Amino Acid (μmol/L)	ADQ-CON	RES-CON	ADQ-MEL	RES-MEL	<i>P</i> value		
					NUT	TRT	NUT*TRT
Alanine	61.35 ± 13.73 <sup>b</sup>	156.58 ± 27.80 <sup>a</sup>	209.48 ± 80.92 <sup>a</sup>	108.93 ± 50.15 <sup>ab</sup>	-	-	<b>&lt;0.01</b>
Sarcosine	5.01 ± 0.34	6.12 ± 0.45	6.60 ± 0.92	6.09 ± 1.21	-	-	<b>0.05</b>
Glycine	56.09 ± 14.46 <sup>b</sup>	193.54 ± 41.24 <sup>a</sup>	201.88 ± 62.83 <sup>a</sup>	129.96 ± 75.90 <sup>ab</sup>	-	-	<b>&lt;0.01</b>
α-Aminobutyric acid	6.24 ± 0.74 <sup>c</sup>	12.01 ± 1.66 <sup>ab</sup>	13.35 ± 2.72 <sup>a</sup>	8.03 ± 1.86 <sup>bc</sup>	-	-	<b>&lt;0.01</b>
Valine	18.86 ± 4.69 <sup>c</sup>	134.91 ± 54.62 <sup>a</sup>	115.05 ± 45.29 <sup>ab</sup>	20.42 ± 4.64 <sup>bc</sup>	-	-	<b>&lt;0.01</b>
β-Aminoisobutyric acid	6.29 ± 0.34	6.37 ± 0.44	6.90 ± 0.31	6.72 ± 0.70	0.65	0.34	0.44
Leucine	9.69 ± 1.44 <sup>b</sup>	71.83 ± 29.76 <sup>a</sup>	62.27 ± 25.54 <sup>a</sup>	9.93 ± 1.59 <sup>b</sup>	-	-	<b>&lt;0.01</b>
Isoleucine	5.87 ± 0.80 <sup>b</sup>	49.57 ± 20.57 <sup>a</sup>	38.05 ± 16.03 <sup>a</sup>	6.08 ± 1.00 <sup>b</sup>	-	-	<b>&lt;0.01</b>
Threonine	11.77 ± 1.85 <sup>b</sup>	33.76 ± 10.97 <sup>a</sup>	34.39 ± 11.16 <sup>a</sup>	12.72 ± 2.71 <sup>b</sup>	-	-	<b>&lt;0.01</b>
Serine	16.00 ± 1.66 <sup>b</sup>	36.06 ± 8.30 <sup>a</sup>	31.13 ± 5.85 <sup>a</sup>	25.99 ± 11.12 <sup>b</sup>	-	-	<b>&lt;0.01</b>
Proline	16.96 ± 3.72 <sup>b</sup>	42.09 ± 11.46 <sup>ab</sup>	48.00 ± 16.06 <sup>a</sup>	21.96 ± 4.28 <sup>ab</sup>	-	-	<b>0.03</b>
Asparagine	8.38 ± 0.42 <sup>bc</sup>	17.92 ± 4.01 <sup>a</sup>	15.02 ± 3.15 <sup>ab</sup>	9.93 ± 1.51 <sup>bc</sup>	-	-	<b>&lt;0.01</b>
Thiaproline	1.23 ± 0.58	1.25 ± 0.59	1.24 ± 0.58	1.08 ± 0.52	0.07	0.57	0.54
Aspartic acid	7.49 ± 0.34	8.93 ± 0.83	8.45 ± 0.55	7.56 ± 0.47	0.54	0.59	0.22
Methionine	6.12 ± 0.29 <sup>b</sup>	10.94 ± 2.52 <sup>a</sup>	14.04 ± 4.81 <sup>a</sup>	6.20 ± 0.29 <sup>b</sup>	-	-	<b>&lt;0.01</b>
4-Hydroxyproline	19.36 ± 3.19	24.01 ± 4.12	33.85 ± 11.98	37.91 ± 14.47	0.74	0.37	0.39
Glutamic acid	35.15 ± 5.71	54.41 ± 9.78	45.77 ± 7.10	36.55 ± 6.17	0.11	0.41	0.10
Phenylalanine	10.95 ± 1.13 <sup>c</sup>	30.32 ± 8.02 <sup>a</sup>	30.73 ± 9.09 <sup>ab</sup>	12.32 ± 1.47 <sup>bc</sup>	-	-	<b>&lt;0.01</b>
α-Aminoadipic acid	11.21 ± 0.46	11.82 ± 0.81	11.97 ± 0.73	13.86 ± 1.97	0.41	0.58	0.83
Glutamine	68.49 ± 11.29 <sup>b</sup>	171.93 ± 40.51 <sup>ab</sup>	240.97 ± 95.72 <sup>a</sup>	107.00 ± 34.60 <sup>ab</sup>	-	-	<b>0.02</b>
Ornithine	17.15 ± 1.15 <sup>b</sup>	37.30 ± 9.04 <sup>a</sup>	39.82 ± 10.76 <sup>a</sup>	20.34 ± 2.23 <sup>ab</sup>	-	-	<b>0.01</b>
Glycine-proline	2.77 ± 0.44 <sup>a</sup>	1.41 ± 0.44 <sup>b</sup>	1.69 ± 0.44 <sup>ab</sup>	2.08 ± 0.41 <sup>ab</sup>	-	-	<b>0.05</b>
Lysine	25.36 ± 2.72	52.33 ± 11.61	50.16 ± 11.41	28.32 ± 5.45	-	-	<b>0.03</b>
Histidine	15.97 ± 1.28	33.09 ± 8.85	34.22 ± 9.11	21.59 ± 6.90	-	-	<b>0.03</b>
Hydroxylysine	9.39 ± 0.24	9.47 ± 0.36	9.55 ± 0.31	10.15 ± 0.94	0.27	0.99	0.99
Tyrosine	11.63 ± 1.35 <sup>b</sup>	29.54 ± 7.70 <sup>a</sup>	28.63 ± 8.21 <sup>a</sup>	13.23 ± 1.65 <sup>ab</sup>	-	-	<b>&lt;0.01</b>
Proline-hydroxyproline	47.74 ± 7.35	31.09 ± 7.35	42.15 ± 7.35	43.92 ± 6.86	0.31	0.62	0.21
Tryptophan	10.15 ± 0.36 <sup>b</sup>	22.71 ± 5.94 <sup>a</sup>	26.83 ± 9.89 <sup>ab</sup>	10.17 ± 0.38 <sup>b</sup>	-	-	<b>&lt;0.01</b>
Cystathionine	0.18 ± 0.18	0.50 ± 0.34	0.89 ± 0.71	1.69 ± 1.58	0.91	0.56	0.43
Cystine	2.88 ± 0.76	5.34 ± 1.56	5.34 ± 1.53	2.38 ± 0.99	0.68	0.84	0.06

Data are presented as means ± standard error. Bolded *P* values are significant at  $P \leq 0.05$ . When there is a significant interaction, the *P* values for main effects of nutrition and treatment are not shown and replaced with a dash (-). Superscripts(a,b,c) denotes differences at  $P \leq 0.05$ . Concentrations are expressed in μmol/L. Experimental units: ADQ-CON, n = 6; RES-CON, n = 6; ADQ-MEL, n = 6; RES-MEL n = 7. Abbreviations: NUT, nutrition; TRT, treatment; NUT\*TRT, nutrition by treatment interaction; ADQ-CON, adequately fed control; RES-CON, restricted fed control; ADQ-MEL, adequately fed melatonin supplemented; RES-MEL, restricted fed melatonin supplemented.

**Supplemental Table S5.** Individual amino acids in maternal plasma in the summer replicate.

Amino Acid (μmol/L)							<i>P</i> value				
	ADQ-CON		RES-CON		ADQ-MEL		RES-MEL		NUT	TRT	NUT*TRT
Alanine	305.54 ±	67.55	319.15 ±	61.21	350.56 ±	73.22	271.85 ±	34.27	0.88	0.76	0.72
Sarcosine	7.70 ±	0.77	7.81 ±	0.37	8.16 ±	0.33	7.90 ±	0.87	0.48	0.86	0.39
Glycine	239.59 ±	15.61	285.05 ±	15.55	315.66 ±	43.59	268.75 ±	15.43	0.44	0.34	0.17
α-Aminobutyric acid	16.30 ±	2.91	22.50 ±	2.91	20.71 ±	2.91	19.81 ±	2.70	0.36	0.77	0.22
Valine	267.23 ±	15.70	202.20 ±	15.75	279.14 ±	16.37	247.25 ±	15.30	<0.01	0.08	0.32
β-Aminoisobutyric acid	8.00 ±	0.50	8.76 ±	0.80	9.88 ±	1.05	8.00 ±	0.50	0.50	0.42	0.16
Leucine	112.69 ±	12.47	95.02 ±	12.51	122.46 ±	12.64	131.99 ±	11.99	0.75	0.07	0.29
Isoleucine	73.77 ±	8.53	61.41 ±	8.56	76.23 ±	8.65	90.34 ±	8.20	0.92	0.08	0.14
Threonine	50.76 ±	3.86	43.17 ±	6.66	59.35 ±	9.66	49.72 ±	3.29	0.31	0.30	0.70
Serine	60.56 ±	5.94	55.33 ±	7.50	81.48 ±	25.53	54.02 ±	6.02	0.55	0.91	0.68
Proline	76.59 ±	11.20	82.43 ±	10.55	94.05 ±	17.95	75.33 ±	7.21	0.94	0.95	0.45
Asparagine	21.49 ±	2.07	23.19 ±	2.07	21.46 ±	2.35	26.01 ±	1.98	0.18	0.51	0.50
Thiaproline	1.00 ±	0.63	1.45 ±	0.65	1.95 ±	0.62	1.66 ±	0.59	0.39	0.50	0.18
Aspartic acid	12.07 ±	1.73	13.84 ±	2.41	29.00 ±	15.82	11.13 ±	1.10	0.97	0.55	0.36
Methionine	19.44 ±	1.81	19.89 ±	1.81	22.43 ±	1.81	21.76 ±	1.68	0.95	0.19	0.76
4-Hydroxyproline	46.29 ±	14.08	41.55 ±	11.25	48.17 ±	14.62	27.97 ±	8.96	0.99	0.80	0.88
Glutamic acid	104.93 ±	25.62	132.44 ±	42.32	150.19 ±	41.91	85.26 ±	24.42	0.63	0.88	0.18
Phenylalanine	62.97 ±	8.37	62.16 ±	7.66	69.34 ±	10.71	51.96 ±	4.76	0.29	0.79	0.74
α-Aminoadipic acid	12.35 ±	1.46	11.15 ±	0.62	11.61 ±	0.57	10.58 ±	0.41	0.27	0.74	0.65
Glutamine	654.88 ±	182.88	702.49 ±	184.74	601.34 ±	131.57	536.72 ±	96.27	0.78	0.87	0.77
Ornithine	43.32 ±	3.02	50.55 ±	3.02	44.21 ±	3.72	56.51 ±	3.08	0.02	0.27	0.44
Glycine-proline	1.71 ±	0.82	1.94 ±	1.13	2.81 ±	1.34	0.46 ±	0.44	0.38	0.66	0.27
Lysine	60.13 ±	7.65	63.75 ±	7.63	76.54 ±	9.19	72.43 ±	7.77	0.98	0.12	0.63
Histidine	51.73 ±	6.20	52.77 ±	3.47	56.74 ±	7.06	60.43 ±	3.88	0.15	0.20	0.52
Hydroxylysine	9.05 ±	0.21 <sup>ab</sup>	9.34 ±	0.21 <sup>a</sup>	9.33 ±	0.26 <sup>ab</sup>	8.70 ±	0.22 <sup>b</sup>	-	-	0.05
Tyrosine	54.68 ±	4.83	53.68 ±	6.72	67.60 ±	10.22	52.24 ±	4.93	0.26	0.52	0.90
Proline-hydroxyproline	37.57 ±	9.38	38.95 ±	9.68	37.91 ±	9.35	27.49 ±	8.79	0.67	0.99	0.97
Tryptophan	40.13 ±	3.45	36.11 ±	3.45	41.21 ±	3.45	37.94 ±	3.21	0.30	0.68	0.91
Cystathionine	3.71 ±	1.91	7.16 ±	4.05	4.69 ±	1.86	2.96 ±	1.54	0.89	0.92	0.40
Cystine	22.03 ±	1.88	23.00 ±	1.88	25.34 ±	1.88	23.63 ±	1.75	0.84	0.30	0.48

Data are presented as means ± standard error. Bolded *P* values are significant at  $P \leq 0.05$ . When there is a significant interaction, the *P* values for main effects of nutrition and treatment are not shown and replaced with a dash (-). Superscripts(a,b,c) denotes differences at  $P \leq 0.05$ . Concentrations are expressed in μmol/L. Experimental units: ADQ-CON, n = 6; RES-CON, n = 6; ADQ-MEL, n = 6; RES-MEL n = 7. Abbreviations: NUT, nutrition; TRT, treatment; NUT\*TRT, nutrition by treatment interaction; ADQ-CON, adequately fed control; RES-CON, restricted fed control; ADQ-MEL, adequately fed melatonin supplemented; RES-MEL, restricted fed melatonin supplemented.

**Supplemental Table S6.** Individual amino acids in fetal plasma in the summer replicate.

Amino Acid (μmol/L)	ADQ-CON	RES-CON	ADQ-MEL	RES-MEL	<i>P</i> value		
					NUT	TRT	NUT*TRT
Alanine	450.59 ± 37.25	440.04 ± 37.26	544.15 ± 45.38	462.58 ± 35.79	0.27	0.14	0.40
Sarcosine	9.91 ± 0.52 <sup>ab</sup>	8.69 ± 0.52 <sup>b</sup>	9.23 ± 0.52 <sup>ab</sup>	10.25 ± 0.48 <sup>a</sup>	-	-	<b>0.04</b>
Glycine	276.83 ± 16.80	256.63 ± 36.04	289.56 ± 14.23	323.04 ± 22.51	0.26	0.16	0.35
α-Aminobutyric acid	21.76 ± 2.47	27.09 ± 2.48	27.77 ± 2.58	33.94 ± 2.41	<b>0.03</b>	<b>0.02</b>	0.87
Valine	251.03 ± 17.16	183.96 ± 32.23	272.30 ± 21.71	224.73 ± 11.98	<b>&lt;0.01</b>	0.27	0.84
β-Aminoisobutyric acid	9.17 ± 0.53	9.69 ± 0.53	9.59 ± 0.54	11.47 ± 0.50	<b>0.03</b>	<b>0.05</b>	0.23
Leucine	90.61 ± 6.23	70.77 ± 12.63	92.54 ± 3.02	85.53 ± 2.21	0.10	0.54	0.79
Isoleucine	56.31 ± 4.22	42.17 ± 7.83	59.75 ± 3.02	57.00 ± 2.00	0.06	0.09	0.43
Threonine	47.46 ± 5.95	45.23 ± 12.02	48.70 ± 4.43	36.77 ± 2.92	<b>&lt;0.01</b>	0.86	0.09
Serine	71.43 ± 5.28	59.20 ± 8.21	70.93 ± 3.05	75.72 ± 5.22	0.76	0.22	0.24
Proline	105.04 ± 6.25	99.15 ± 15.28	105.15 ± 8.97	114.13 ± 4.29	0.48	0.58	0.48
Asparagine	24.88 ± 1.19	22.80 ± 2.85	23.86 ± 1.30	25.75 ± 0.72	-	-	<b>0.05</b>
Thiaproline	0.96 ± 0.61	1.95 ± 0.62	0.97 ± 0.61	1.26 ± 0.59	0.66	0.22	0.40
Aspartic acid	13.51 ± 1.58	14.47 ± 1.59	15.23 ± 1.61	19.64 ± 1.51	0.10	<b>0.04</b>	0.31
Methionine	20.49 ± 2.21	20.00 ± 2.21	23.13 ± 2.21	19.52 ± 2.05	0.36	0.62	0.48
4-Hydroxyproline	72.81 ± 5.86	73.41 ± 5.88	79.11 ± 5.94	84.03 ± 5.63	0.64	0.16	0.72
Glutamic acid	139.15 ± 24.30	139.69 ± 24.30	191.46 ± 24.30	206.71 ± 22.29	0.74	<b>0.02</b>	0.77
Phenylalanine	81.82 ± 4.24	72.90 ± 12.68	83.59 ± 5.47	69.99 ± 4.59	0.21	0.33	0.41
α-Aminoadipic acid	12.03 ± 0.33	11.56 ± 0.38	12.89 ± 0.79	11.59 ± 0.29	0.22	0.88	0.90
Glutamine	900.51 ± 99.07	858.60 ± 99.35	796.93 ± 103.26	1140.78 ± 96.52	0.15	0.37	0.08
Ornithine	51.02 ± 4.84	52.27 ± 4.84	53.73 ± 5.00	59.61 ± 4.58	0.47	0.30	0.64
Glycine-proline	2.52 ± 0.56	3.14 ± 0.50	4.08 ± 1.26	4.21 ± 0.72	0.27	0.14	0.85
Lysine	76.16 ± 7.56	62.56 ± 7.56	75.75 ± 8.88	71.16 ± 7.31	0.28	0.60	0.58
Histidine	61.94 ± 4.6 <sup>a</sup>	53.04 ± 4.63 <sup>ab</sup>	43.92 ± 4.8 <sup>b</sup>	62.18 ± 4.50 <sup>a</sup>	-	-	<b>&lt;0.01</b>
Hydroxylysine	9.84 ± 0.15	9.64 ± 0.15	9.83 ± 0.16	9.83 ± 0.14	0.52	0.54	0.54
Tyrosine	66.99 ± 7.69	62.38 ± 7.69	80.53 ± 7.69	59.99 ± 7.14	0.11	0.47	0.30
Proline-hydroxyproline	52.58 ± 4.45	61.13 ± 4.46	51.82 ± 4.64	64.26 ± 4.34	<b>0.03</b>	0.79	0.68
Tryptophan	45.18 ± 3.70	40.22 ± 3.71	42.87 ± 3.86	49.74 ± 3.60	0.80	0.34	0.14
Cystathionine	6.20 ± 1.19	9.04 ± 1.93	8.04 ± 2.51	10.35 ± 2.00	0.10	0.46	0.38
Cystine	20.14 ± 0.99	21.39 ± 2.75	23.58 ± 1.85	21.72 ± 0.80	0.80	<b>0.04</b>	0.95

Data are presented as means ± standard error. Bolded *P* values are significant at  $P \leq 0.05$ . When there is a significant interaction, the *P* values for main effects of nutrition and treatment are not shown and replaced with a dash (-). Superscripts(a,b,c) denotes differences at  $P \leq 0.05$ . Concentrations are expressed in μmol/L. Experimental units: ADQ-CON, n = 6; RES-CON, n = 6; ADQ-MEL, n = 6; RES-MEL n = 7. Abbreviations: NUT, nutrition; TRT, treatment; NUT\*TRT, nutrition by treatment interaction; ADQ-CON, adequately fed control; RES-CON, restricted fed control; ADQ-MEL, adequately fed melatonin supplemented; RES-MEL, restricted fed melatonin supplemented.

**Supplemental Table S7.** Individual amino acids in amnion in the summer replicate.

Amino Acid (μmol/L)	ADQ-CON	RES-CON	ADQ-MEL	RES-MEL	NUT	TRT	NUT*TRT
Alanine	247.61 ± 120.46	161.39 ± 22.29	149.37 ± 31.52	139.67 ± 36.38	0.70	0.45	0.70
Sarcosine	7.68 ± 0.96	6.34 ± 0.46	6.30 ± 0.63	8.53 ± 2.67	0.30	0.42	0.90
Glycine	190.46 ± 43.19	201.58 ± 48.70	189.75 ± 43.29	183.55 ± 74.41	0.47	0.38	0.42
α-Aminobutyric acid	13.57 ± 4.19	13.54 ± 2.19	9.19 ± 1.07	9.58 ± 1.52	0.88	0.06	0.25
Valine	196.32 ± 69.56	177.73 ± 52.55	107.88 ± 37.62	101.15 ± 49.88	0.77	0.13	0.95
β-Aminoisobutyric acid	7.74 ± 0.59	6.88 ± 0.35	6.83 ± 0.46	8.94 ± 2.26	0.35	0.39	0.87
Leucine	81.12 ± 29.19	88.11 ± 25.84	53.34 ± 18.43	49.84 ± 24.55	0.97	0.08	0.74
Isoleucine	53.77 ± 20.56	58.27 ± 17.52	34.97 ± 13.28	33.91 ± 17.42	0.79	0.09	0.78
Threonine	37.60 ± 10.35	38.27 ± 9.12	31.28 ± 7.30	25.38 ± 7.86	0.61	0.17	0.64
Serine	44.72 ± 8.86	36.26 ± 7.48	31.96 ± 8.06	31.41 ± 7.48	0.58	0.28	0.63
Proline	61.86 ± 21.02	47.55 ± 8.76	33.03 ± 8.18	40.54 ± 11.06	0.93	0.23	0.54
Asparagine	18.63 ± 3.49	16.77 ± 2.78	14.06 ± 1.99	13.53 ± 2.48	0.54	0.24	0.97
Thiaproline	2.35 ± 0.59	0.43 ± 0.43	0.96 ± 0.61	0.82 ± 0.53	<b>0.04</b>	0.19	0.15
Aspartic acid	10.17 ± 1.00	7.93 ± 0.39	8.41 ± 0.62	8.17 ± 0.47	0.14	0.32	0.16
Methionine	14.68 ± 3.04	12.86 ± 2.34	10.88 ± 1.83	10.27 ± 2.39	0.52	0.15	0.83
4-Hydroxyproline	31.06 ± 12.39	22.75 ± 4.85	20.70 ± 4.88	60.85 ± 42.63	0.46	0.77	0.89
Glutamic acid	65.25 ± 14.49	41.69 ± 5.71	38.01 ± 4.80	36.84 ± 5.12	<b>0.01</b>	0.17	0.91
Phenylalanine	41.51 ± 13.60	36.18 ± 7.14	24.79 ± 5.54	22.09 ± 7.05	0.71	0.11	0.94
α-Amino adipic acid	13.88 ± 1.34	10.55 ± 0.41	12.93 ± 2.62	12.97 ± 2.74	0.11	0.52	0.40
Glutamine	232.72 ± 79.70	208.12 ± 34.34	173.71 ± 38.50	175.49 ± 46.20	0.82	0.38	0.60
Ornithine	38.05 ± 8.07	36.60 ± 6.47	26.64 ± 3.50	35.79 ± 10.44	0.88	0.19	0.91
Glycine-proline	1.34 ± 0.66	1.49 ± 0.67	2.09 ± 0.95	1.93 ± 0.59	0.67	0.31	0.23
Lysine	50.89 ± 6.56	49.13 ± 8.47	42.48 ± 8.06	57.68 ± 27.69	0.43	0.15	0.58
Histidine	41.62 ± 8.00	38.57 ± 6.12	34.90 ± 6.74	27.97 ± 5.62	0.28	0.12	0.59
Hydroxylysine	10.38 ± 1.18	8.89 ± 0.10	9.74 ± 0.79	12.46 ± 3.52	0.44	0.92	0.75
Tyrosine	41.27 ± 10.79	34.34 ± 6.68	24.38 ± 4.60	21.81 ± 6.58	0.31	<b>0.02</b>	0.42
Proline-hydroxyproline	46.93 ± 15.60	31.94 ± 7.82	44.52 ± 4.60	43.37 ± 10.37	0.66	0.41	0.06
Tryptophan	28.86 ± 7.86	25.54 ± 5.26	19.89 ± 4.22	18.55 ± 5.56	0.19	0.07	0.79
Cystathionine	2.17 ± 1.98	0.30 ± 0.19	0.89 ± 0.71	6.26 ± 6.26	0.64	0.54	0.73
Cystine	8.15 ± 1.31	11.40 ± 2.55	8.94 ± 1.79	7.85 ± 1.87	0.83	0.54	0.29

Data are presented as means ± standard error. Bolded *P* values are significant at  $P \leq 0.05$ . When there is a significant interaction, the *P* values for main effects of nutrition and treatment are not shown and replaced with a dash (-). Superscripts(a,b,c) denotes differences at  $P \leq 0.05$ . Concentrations are expressed in μmol/L. Experimental units: ADQ-CON, n = 6; RES-CON, n = 6; ADQ-MEL, n = 6; RES-MEL n = 7. Abbreviations: NUT, nutrition; TRT, treatment; NUT\*TRT, nutrition by treatment interaction; ADQ-CON, adequately fed control; RES-CON, restricted fed control; ADQ-MEL, adequately fed melatonin supplemented; RES-MEL, restricted fed melatonin supplemented.