Supplemental Table 1 Percentages of individual amino acids in total amino acids (total peptide-bound plus total free amino acids) in animal- and plant-derived feedstuffs

Amino acid	Animal-source feedstuffs											Plant-source feedstuffs		
	BSFM	CBPM	CVD	Feather meal	FM-M	FM-P	FM-SE	SDPM	PBM (PFG)	SDPP	SDEP	Algae SM	SBM	SPC
Ala	6.23^{e} ± 0.03	6.62^{c} ± 0.03	5.17^{i} ± 0.05	4.46^{j} ± 0.03	6.03^{f} ± 0.05	7.12^{b} ± 0.05	6.52^{c} ± 0.05	5.95^{f} ± 0.04	6.20^{e} ± 0.06	5.76g ± 0.01	5.45^{h} ± 0.04	7.55^{a} ± 0.04	4.44^{jk} ± 0.05	4.30^{k} ± 0.04
β-Ala	0.005^{e} ± 0.000	0.007^{d} ± 0.000	0.015^{b} ± 0.001	0.009^{c} ± 0.000	0.000 ± 0.000	0.018^{a} ± 0.000	0.020^{a} ± 0.000	0.014^{b} ± 0.001	0.008^{cd} ± 0.000	0.000 ± 0.000	0.009^{c} ± 0.000	0.001^{f} ± 0.000	0.002^{f} ± 0.000	0.001^{f} ± 0.000
Arg	5.24^{i} ± 0.04	6.93^{b} ± 0.05	5.04^{j} ± 0.03	6.31^{e} ± 0.03	6.10^{f} ± 0.04	5.38^{i} ± 0.05	5.89^{g} ± 0.03	6.09^{f} ± 0.04	6.46^{d} ± 0.08	5.72^{h} ± 0.02	6.06^{f} ± 0.05	6.69^{c} ± 0.03	7.22^{a} ± 0.04	7.24^{a} ± 0.03
Asn	3.82^{e} ± 0.02	3.80^{e} ± 0.03	3.13^{g} ± 0.02	1.93^{j} ± 0.01	3.76^{e} ± 0.02	3.43^{f} ± 0.01	3.69^{e} ± 0.04	2.57^{i} ± 0.01	3.99^{d} ± 0.02	2.98^{h} ± 0.04	4.27^{c} ± 0.02	4.31^{c} ± 0.02	4.73^{a} ± 0.03	4.51^{b} ± 0.01
Asp	6.03^{c} ± 0.03	5.74^{d} ± 0.05	4.59^{g} ± 0.03	3.32^{h} ± 0.03	5.53^{e} ± 0.03	5.13^{f} ± 0.04	5.49^{e} ± 0.07	6.30^{b} ± 0.03	6.01^{c} ± 0.03	5.98^{c} ± 0.07	5.71^{d} ± 0.02	5.53^{e} ± 002	7.03^{a} ± 0.05	6.99^{a} ± 0.01
Cit	0.002^{g} ± 0.000	0.000 ± 0.000	0.002^{g} ± 0.000	0.000 ± 0.000	0.011^{d} ± 0.000	0.032^{c} ± 0.001	0.046^{b} ± 0.001	0.24^{a} ± 0.01	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.001^{h} ± 0.000	0.005^{e} ± 0.000	0.003^{e} ± 0.000
Cys^{A}	1.37^{g} ± 0.01	1.56^{f} ± 0.02	1.52^{f} ± 0.02	4.51^{a} ± 0.02	1.12^{h} ± 0.01	1.07^{i} ± 0.01	0.97^{j} ± 0.01	1.67^{de} ± 0.01	1.62^{e} ± 0.03	3.07^{b} ± 0.03	2.17^{c} ± 0.04	1.14^{h} ± 0.01	1.58^{ef} ± 0.01	1.70^{d} ± 0.02
Gln	4.98^{i} ± 0.01	5.59^{d} ± 0.03	4.67^{j} ± 0.03	3.15^{k} ± 0.02	5.98^{c} ± 0.03	5.10^{h} ± 0.02	5.62^{d} ± 0.03	4.72^{i} ± 0.05	5.31^{f} ± 0.03	5.20^{gh} ± 0.06	4.60^{j} ± 0.02	5.48^{e} ± 0.03	8.51^{b} ± 0.06	8.65^{a} ± 0.04
Glu	6.83^{i} ± 0.01	7.79^{g} ± 0.04	7.94^{f} ± 0.05	5.32^{j} ± 0.03	8.84^{d} ± 0.04	7.71^{g} ± 0.03	8.49^{e} ± 0.05	9.78^{b} ± 0.04	7.40^{h} ± 0.04	7.83^{f} ± 0.08	8.70^{d} ± 0.04	8.79^{d} ± 0.05	9.50^{c} ± 0.06	10.4^{a} ± 0.05
Gly	5.77^{h} ± 0.05	8.66^{d} ± 0.06	10.3^{b} ± 0.03	± 9.70^{c} ± 0.04	7.08^{g} ± 0.05	7.64^{f} ± 0.08	8.34^{e} ± 0.05	8.39^{e} ± 0.06	10.7^{a} ± 0.05	3.94^{l} ± 0.05	3.89^{l} ± 0.02	5.41^{i} ± 0.04	5.18^{j} ± 0.05	4.48^{k} ± 0.04
His	3.39^{b} ± 0.04	1.98^{f} ± 0.02	0.93^{h} ± 0.01	0.97^{h} ± 0.01	2.34^{d} ± 0.03	2.15^{e} ± 0.03	2.07^{f} ± 0.03	2.18^{e} ± 0.02	2.04^{f} ± 0.02	4.24^{a} ± 0.08	2.30^{d} ± 0.02	1.67^{g} ± 0.02	2.59^{c} ± 0.06	2.60^{c} ± 0.03
Hyp	2.52^{d} ± 0.02	2.70^{cd} ± 0.07	2.17^{e} ± 0.02	5.38^{a} ± 0.05	2.60^{d} ± 0.05	2.74^{cd} ± 0.03	2.82^{c} ± 0.05	1.34^{f} ± 0.02	3.50^{b} ± 0.04	0.024^{h} ± 0.001	0.036^{g} ± 0.001	0.018^{ij} ± 0.001	0.020^{i} ± 0.001	0.016^{j} ± 0.001
Ile	4.01^{e} ± 0.03	3.97^{e} ± 0.04	4.81^{b} ± 0.02	4.09^{e} ± 0.04	4.02^{e} ± 0.03	4.14^{de} ± 0.05	3.97^{e} ± 0.05	4.14^{de} ± 0.05	3.70^{f} ± 0.04	3.21^{g} ± 0.02	4.72^{bc} ± 0.05	5.27^{a} ± 0.03	4.57^{c} ± 0.06	4.71^{bc} ± 0.03
Leu	6.46^{i} ± 0.04	7.69^{e} ± 0.04	7.64^{e} ± 0.04	7.48^{f} ± 0.04	7.48^{f} ± 0.03	7.93^{cd} ± 0.05	6.53^{i} ± 0.04	7.29^{g} ± 0.03	6.75^{h} ± 0.06	8.75^{a} ± 0.04	7.32^{g} ± 0.06	8.16^{b} ± 0.04	7.78^{de} ± 0.09	7.23^{g} ± 0.03
Lys	6.38^{e} ± 0.05	6.59^{d} ± 0.05	6.29^{e} ± 0.07	2.33^{g} ± 0.02	7.41^{b} ± 0.04	7.90^{a} ± 0.04	6.49^{de} ± 0.03	6.89^{c} ± 0.05	5.52^{f} ± 0.06	7.93^{a} ± 0.03	6.49^{de} ± 0.05	5.39^{f} ± 0.04	6.33^{e} ± 0.06	6.30^{e} ± 0.04
Met	2.38^{c} ± 0.02	2.08^{ef} ± 0.02	1.98^{f} ± 0.02	0.81^{i} ± 0.01	3.27^{a} ± 0.06	3.25^{a} ± 0.03	2.89^{b} ± 0.03	2.03^{f} ± 0.02	2.15^{de} ± 0.02	2.28^{c} ± 0.02	3.19^{a} ± 0.02	2.80^{b} ± 0.03	1.36^{h} ± 0.01	1.46^{g} ± 0.04
Orn	0.001^{g} ± 0.000	0.016^{e} ± 0.001	0.012^{f} ± 0.000	0.000 ± 0.000	0.037^{b} ± 0.001	0.033^{c} ± 0.001	0.025^{d} ± 0.001	0.26^{a} ± 0.01	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.004 ± 0.000	0.000 ± 0.000
Phe	4.32^{e} ± 0.04	3.93^{f} ± 0.03	4.63^{d} ± 0.02	4.28^{e} ± 0.02	3.84^{f} ± 0.03	3.48^{h} ± 0.04	3.77^{fg} ± 0.04	3.95^{f} ± 0.04	3.61^{gh} ± 0.03	5.49^{a} ± 0.03	4.83^{c} ± 0.05	5.00^{bc} ± 0.03	4.96^{bc} ± 0.07	5.05^{b} ± 0.08
Pro	5.79^{f} ± 0.05	6.27^{de} ± 0.09	6.93^{c} ± 0.06	12.6^{a} ± 0.10	6.19^{e} ± 0.06	6.42^{d} ± 0.04	6.82^{c} ± 0.06	5.36^{g} ± 0.05	7.90^{b} ± 0.05	5.00^{h} ± 0.04	5.39^{g} 0.05	4.03^{j} ± 0.04	5.50^{g} ± 0.05	4.35^{i} ± 0.04
Ser	4.65^{i} ± 0.04	4.45^{j} ± 0.06	8.08^{c} ± 0.05	9.65^{a} ± 0.04	4.18^{k} ± 0.03	4.38^{j} ± 0.05	4.66^{i} ± 0.04	5.71^{fg} ± 0.06	4.08^{k} ± 0.03	5.78^{e} ± 0.04	8.56^{b} ± 0.04	5.61^{g} ± 0.04	4.83^{h} ± 0.05	6.03^{d} ± 0.03
Taurine	0.019^{h} ± 0.000	0.31^{e} ± 0.01	0.17^{g} ± 0.001	0.015^{h} ± 0.000	0.68^{c} ± 0.005	1.13^{b} ± 0.02	1.40^{a} ± 0.01	0.28^{f} ± 0.01	0.61^{d} ± 0.01	0.28^{f} ± 0.01	0.052^{g} ± 0.001	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Thr	5.06^{b} ± 0.05	4.04^{g} ± 0.05	2.49^{h} ± 0.03	4.24^{e} ± 0.02	4.16^{ef} ± 0.04	4.28^{e} ± 0.07	4.47^{d} ± 0.03	4.83^{c} ± 0.04	3.98^{g} ± 0.03	5.15^{b} ± 0.02	4.92^{c} ± 0.05	5.33^{a} ± 0.02	4.01^{g} ± 0.02	4.08^{fg} ± 0.02
Trp	1.40^{b} ± 0.01	1.11^{de} ± 0.01	1.29^{c} ± 0.01	0.87^{g} ± 0.01	1.17^{d} ± 0.01	1.03^{ef} ± 0.01	1.00^{f} ± 0.01	1.06^{ef} ± 0.01	0.98^{f} ± 0.01	1.58^{a} ± 0.02	1.53^{a} ± 0.01	1.32^{bc} ± 0.02	1.40^{b} ± 0.01	1.51^{a} ± 0.03
Tyr	7.64^{a} ± 0.04	3.33^{f} ± 0.03	3.21^{g} ± 0.02	2.31^{i} ± 0.04	3.14^{g} ± 0.04	3.02^{h} ± 0.06	3.36^{f} ± 0.04	3.79^{d} ± 0.03	2.93^{h} ± 0.04	4.07^{c} ± 0.02	4.14^{c} ± 0.04	4.89^{b} ± 0.03	3.78^{d} ± 0.02	3.58^{e} ± 0.02
Val	5.69^{c} ± 0.05	4.84^{f} ± 0.03	6.98^{a} ± 0.05	6.29^{b} ± 0.04	5.02^{e} ± 0.04	5.49^{d} ± 0.03	4.62^{hi} ± 0.03	5.17^{e} ± 0.04	4.53^{i} ± 0.04	5.74^{c} ± 0.04	5.67^{c} ± 0.04	5.63^{c} ± 0.03	4.68^{gh} ± 0.09	4.77^{g} ± 0.04

Values, expressed as % (g/g), are means ± SEM, n = 6. Total peptide-bound amino acids are those in all peptides [perchloric acid-soluble peptides (oligopeptides) plus perchloric acid-insoluble polypeptides (proteins)]. The molecular weights of intact amino acids were used for the calculation.

[A] Cysteine + ½ cystine

[a-k]: Within a row, means not sharing the same superscript letter differ ($P < 0.05$).

BSFM black soldier fly larvae meal; *CBPM* chicken by-product meal; *Cit* citrulline; *CVD* chicken visceral digest; *FM-M* fishmeal (United States Menhaden); FM-P *fishmeal* (Peruvian anchovy); *FM-SE* fishmeal (Southeast Asian miscellaneous marine fishes); *Hyp* 4-hydroxyproline; *Orn* ornithine; *PBM (PFG)* poultry by-product meal (pet-food grade); *PCA* perchloric acid; *SBM* soybean meal; *SDEP* spray-dried egg product; *SDPM* spray-dried peptone from enzymes-treated porcine mucosal tissues; *SDPP* spray-dried poultry plasma; *SM* spirulina meal; *SPC* soy protein concentrate

Supplemental Table 2 Published data on the content of crude protein (CP) and total amino acids (total peptide-bound plus total free amino acids) in sprayed-dried egg products, chicken by-product meal, and poultry by-product meal (pet-food grade, PFG)

CP or total amino acid	Spray-dried egg product				Chicken by-product meal			Poultry by-product meal (PFG)		
	Donadelli et al. (2019)	Norberg et al. (2004)	Donadelli et al. (2019)[a]	Li and Wu (2020)[b]	Donadelli et al. (2019)	Dust et al. (2005)	Li and Wu (2020)[b]	Dozier et al. (2003)	Murray et al. (1997)	Li and Wu (2020)[b]
CP	500	521	490	514	677	628	694	689	676	725
Ala	---	28.0	---	36.1	---	---	46.3	---	41	41.1
β-Ala	---	---	---	0.063	---	---	0.052	---	---	0.055
Arg	3.27	32.0	3.15	40.2	4.80	48.1	48.5	36.4	44	42.9
Asn + Asn	---	49.4	---	66.1	---	---	66.7	---	52	66.4
Asn	---	---	---	28.3	---	---	26.6	---	---	26.5
Asp	---	---	---	37.8	---	---	40.1	---	---	39.9
Cit	---	---	---	0.0019	---	---	0.0011	---	---	0.0013
Cys[c]	1.14	12.2	1.10	14.4	0.95	---	10.9	1.88	18	10.8
Gln + Glu	---	62.9	---	88.1	---	---	94.1	61.5	85	84.4
Gln	---	---	---	30.5	---	---	39.6	---	---	35.3
Glu	---	---	---	57.6	---	---	54.5	---	---	49.1
Gly	1.91	16.4	0.02	25.8	6.07	---	60.6	48.8	57	70.9
His	1.29	12.1	1.25	15.2	1.41	13.7	13.9	16.9	16	13.6
Hyp	0.01	---	0.01	0.24	1.82	---	18.9	---	---	23.2
Ile	2.93	27.4	2.91	31.3	2.79	24.2	27.7	13.6	26	24.6
Leu	4.67	44.1	4.58	48.5	5.10	44.9	53.9	31.3	46	44.7
Lys	4.14	35.8	4.02	43.0	4.59	40.6	46.1	30.4	38	36.6
Met	1.74	16.3	1.70	21.2	1.38	13.5	14.6	8.75	11	14.3
Orn	---	---	---	0.0029	---	---	0.11	---	---	0.028
Phe	3.01	28.1	2.92	32.0	2.83	25.4	27.5	15.9	25	24.0
Pro	1.90	16.7	1.81	35.6	4.13	---	43.9	---	53	52.4
Ser	3.14	28.9	2.93	56.7	2.62	---	31.1	---	27	27.1
Taurine	0.07	---	0.05	0.34	0.52	---	2.14	---	---	4.01
Thr	2.37	22.5	2.27	32.6	2.76	23.7	28.3	19.0	25	26.4
Trp	0.87	10.1	0.85	10.2	0.73	4.8	7.74	---	---	6.50
Tyr	2.27	20.3	2.13	27.4	2.44	---	23.3	---	18	19.4
Val	3.65	33.8	3.56	37.5	3.39	31.6	33.9	18.1	31	30.1

Values are means and expressed as g/kg of dry matter.
[a] Spray-dried inedible whole egg
[b] Li and Wu (2020; present study)
[c] Cysteine + ½ cystine
"---" denotes that data are not available.
Cit citrulline; *Hyp* 4-hydroxyproline; *Orn* ornithine

Supplemental Table 3 Published data on the content of crude protein (CP) and total amino acids (total peptide-bound plus total free amino acids) in black soldier fly larvae meal and chicken visceral digest

CP or total amino acid	Black soldier fly larvae meal							Chicken visceral digest			
	Dumas et al. (2018)	Kawasaki et al. (2019)	Lei et al. (2019)	Renna et al. (2017)	Shumo et al. (2019)	Sprangh-ers et al. (2017)[a]	Li and Wu (2020)[b]	Djisson et al. (2018)	Jamdar and Harikumar (2008)	Murray et al. (1997)	Li and Wu (2020)[b]
CP	471	---	583	553	411	---	441	746	545	456	721
Ala	---	24.5	39.3	34.3	---	25.2	33.0	28.0	39	25	44.3
β-Ala	---	---	---	---	---	---	0.027	---	---	---	0.13
Arg	21.9	19.4	29.7	21.6	1.18	20.3	25.8	30.5	44	25	43.2
Asn + Asn	---	34.3	52.7	37.1	---	37.8	52.1	44	47	34	66.2
Asn	---	---	---	---	---	---	20.2	---	---	---	26.9
Asp	---	---	---	---	---	---	31.9	---	---	---	39.3
Cit	---	---	---	---	---	---	0.010	---	---	---	0.015
Cys[c]	4.2	2.8	7.6	0.55	---	2.5	7.23	---	---	10	13.1
Gln + Glu	---	39.9	66.4	48.7	0	41.9	62.6	65.5	63	50	108.1
Gln	---	---	---	---	0	---	26.4	---	---	---	40.0
Glu	---	---	---	---	0	---	36.2	---	---	---	68.1
Gly	---	19.0	29.2	23.2	---	22.6	30.5	24.0	47	36	88.5
His	10.6	13.2	17.4	12.2	3.75	13.6	17.9	12.0	21	10	7.99
Hyp	14.8	---	---	---	8.25	---	13.4	---	---	---	18.6
Ile	19.2	15.7	22.4	18.3	1.72	17.2	21.2	12.5	37	15	41.2
Leu	30.0	25.9	39.2	28.8	3.22	28.6	34.2	42.0	80	28	65.5
Lys	27.9	22.2	37.1	21.0	4.40	23.4	33.7	26.5	59	24	53.9
Met	6.3	5.8	14.4	11.6	6.54	7.6	12.6	10.5	12	8	17.0
Orn	---	---	---	---	---	---	0.0040	---	---	---	0.10
Phe	17.9	15.1	23.8	16.6	2.04	17.0	22.9	21.5	23	16	39.7
Pro	---	21.6	31.4	30.4	1.61	22.5	30.6	22.0	---	23	59.3
Ser	---	16.2	25.5	20.5	---	16.6	24.6	23.5	27	17	69.2
Taurine	3.7	---	---	---	---	---	0.095	---	---	---	1.41
Thr	16.7	14.2	23.4	17.1	---	16.4	26.8	18.5	21	16	21.4
Trp	5.4	5.3	7.06	---	---	6.7	7.41	8.5	---	---	11.0
Tyr	---	23.0	33.5	26.6	2.36	---	40.4	22.5	21	13	27.5
Val	---	22.5	40.0	27.1	7.72	24.1	30.1	15.0	58	19	59.8

Values are means and expressed as g/kg of dry matter.
[a] Black soldier fly prepupae reared on a chicken feed meal
[b] Li and Wu (2020; present study)
[c] Cysteine + ½ cystine
"---" denotes that data are not available.
Cit citrulline; *Hyp* 4-hydroxyproline; *Orn* ornithine

Supplemental Table 4 Published data on the content of crude protein (CP) and total amino acids (total peptide-bound plus total free amino acids) in spray-dried peptone from enzymes-treated porcine mucosal tissues and spray-dried plasma

CP or total amino acids	Spray-dried peptone from enzymes-treated porcine mucosal tissues (SDPM)						Spray-dried plasma				
							SDAP	SDCP	SDPLP	SDPOP	SDPP
	Frikha et al. (2014)	Kim et al. (2000)	Myers et al. (2014)[a]	Sulabo et al. (2013)[b]	Sulabo et al. (2013)[a]	Li and Wu (2020)[c]	Myers et al. (2014)	Zhang et al. (2015)	Kim et al. (2000)	Zhang et al. (2015)	Li and Wu (2020)[c]
CP	570	587	580	566	625	622	610	774	861	790	731
Ala	26.0	26.2	---	26.1	34.0	39.7	---	---	39.5	---	52.2
β-Ala	---	---	---	---	---	0.092	---	---	---	---	0.017
Arg	39.9	20.5	36.3	33.1	36.4	40.6	49.5	49.8	38.7	42.1	51.8
Asn + Asn	57.3	19.8	---	50.4	56.8	59.2	---	---	85.5	---	81.2
Asn	---	---	---	---	---	17.2	---	---	---	---	27.0
Asp	---	---	---	---	---	42.0	---	---	---	---	54.2
Cit	---	---	---	---	---	1.58	---	---	---	---	0.0033
Cys[d]	3.43	1.6	7.67	6.44	7.46	11.1	28.6	---	7.3	---	27.8
Gln + Glu	94.2	112.3	---	74.9	79.1	96.7	---	---	106.9	---	118.0
Gln	---	---	---	---	---	31.5	---	---	---	---	47.1
Glu	---	---	---	---	---	65.2	---	---	---	---	70.9
Gly	28.8	14.2	---	25.4	31.6	55.9	---	---	30.8	---	35.7
His	12.9	13.6	13.4	12.6	14.2	14.5	27.7	20.3	24.2	33.8	38.4
Hyp	---	---	---	---	---	8.92	---	---	---	---	0.22
Ile	26.6	14.3	25.5	23.3	27.5	27.6	29.5	29.5	16.7	25.2	29.1
Leu	43.6	26.1	44.3	40.3	47.5	48.6	82.7	72.8	68.4	76.5	79.2
Lys	35.2	43.5	38.9	37.9	51.0	46.0	74.4	49.4	60.4	63.7	71.8
Met	9.87	5.2	9.24	8.45	11.4	13.6	8.15	17.9	18.6	13.8	20.6
Orn	---	---	---	---	---	1.74	---	---	---	---	0.0058
Phe	25.9	19.1	25.9	23.5	26.0	26.3	48.1	35.3	34.0	45.3	49.7
Pro	29.8	29.0	---	24.6	28.0	35.7	---	---	44.5	---	45.3
Ser	29.5	17.6	---	17.6	19.9	38.1	---	---	53.7	---	52.3
Taurine	---	---	---	---	---	1.85	---	---	---	---	2.57
Thr	24.1	21.7	22.9	19.1	23.8	32.2	51.3	44.9	53.3	37.2	46.6
Trp	6.44	---	6.83	4.96	5.15	7.10	14.8	15.1	---	9.95	14.3
Tyr	19.5	11.5	---	17.1	21.1	25.3	---	---	19.3	---	36.8
Val	29.3	25.5	29.0	27.8	33.8	34.4	53.7	44.1	14.6	51.2	52.0

Values are means and expressed as g/kg of dry matter.
[a] PEP2
[b] PEP50
[c] Li and Wu (2020; present study)
[d] Cysteine + ½ cystine.
"---" denotes that data are not available.
Cit citrulline; *Hyp* 4-hydroxyproline; *Orn* ornithine; *SDAP* spray-dried animal plasma (92% dry matter); *SDCP* spray-dried chicken plasma; *SDPLP* spray-dried plasma protein; *SDPOP* spray-dried porcine plasma; *SDPP* spray-dried poultry plasma

Supplemental Table 5 Published data on the content of agmatine and polyamines (putrescine, spermidine and spermine) in feedstuffs

Feedstuff	Study	Agmatine	Putrescine	Spermidine	Spermine	Total PAs
Chicken by-product meal	Kerr et al. (2017)	---	212	72.2	137	421
Chicken by-product meal	Li and Wu (2020)[a]	230	178	504	514	1196
Poultry by-product meal	Kerr et al. (2017)	---	190	13.5	38.7	242
Poultry by-product meal	Li and Wu (2020)[a]	320	68.4	574	829	1470
Meat and bone meal	Bryan (2018)	5.3	123	11.7	14.9	150
Meat and bone meal	Kerr et al. (2017)	---	39.3 – 177	5.8 – 15.9	14.3 – 41.5	59.4 – 234
Meat and bone meal	Li and Wu (2020)[b]	6.0 ± 0.21	129 ± 4.5	13.4 ± 0.56	37.2 ± 1.8	180 ± 5.3
Feather meal	Bryan (2018)	0.68	31.5	10.9	7.6	50
Feather meal	Kerr et al. (2017)	---	64.2 – 131	13.7	11.7 – 14.1	89.6 – 159
Feather meal	Li and Wu (2020)[a]	123	33.8	809	324	1167
Fishmeal (type not specified)	Bryan (2018)	240	427	47.2	22.5	497
Fishmeal (United States Menhaden)	Li and Wu (2020)[a]	237	105	22.8	143	271
Fishmeal (Peruvian anchovy)	Li and Wu (2020)[a]	992	187	253	1733	2173
Fishmeal (Southeast Asian)[c]	Li and Wu (2020)[a]	1791	1166	381	228	1775
Soybean meal	Bryan (2018)	17.1	14.3	162	27.1	203
Soybean meal	Li and Wu (2020)[a]	339	21.1	1266	431	1717

Values are means and expressed as mg/kg of dry matter.

[a] Present study

[b] Unpublished data (means ± SEM, n = 6). Meat and bone meal contained 541 ± 2.9 g crude protein per kg of dry matter and 196 ± 7.4 mg taurine per kg of dry matter.

[c] Miscellaneous marine fishes

"---" denotes that data are not available.

PAs polyamines (putrescine + spermidine + spermine)