**Supplemental A.** Protein digestibility corrected amino acid (PDCAA) reference ratios for ingredients calculated according to requirement for 2 to 5 year old child\*

|  |  |
| --- | --- |
|  | Ingredient |
| Item | WPI | WPC | MPC | SMP | PPC | SPI | Soy flour | Wheat |
| PDCAA reference ratio, 2 to 5years† |  |
|  Histidine | 1.03 | 1.13 | 1.53 | 1.56 | 1.29 | 1.32 | 1.30 | 1.17 |
|  Isoleucine | 2.43 | 2.20 | 1.84 | 1.78 | 1.41 | 1.63 | 1.45 | 1.03 |
|  Leucine | 1.72 | 1.75 | 1.49 | 1.46 | 1.05 | 1.16 | 1.05 | 0.87 |
|  Lysine | 1.71 | 1.68 | 1.35 | 1.38 | 1.21 | 1.02 | 0.98 | 0.50 |
|  Sulfur amino acids | 1.87 | 1.84 | 1.31 | 1.21 | 0.77 | 0.93 | 1.00 | 1.36 |
|  Aromatic amino acids | 0.99 | 1.07 | 1.55 | 1.45 | 1.22 | 1.35 | 1.21 | 0.89 |
|  Threonine | 2.22 | 1.98 | 1.27 | 1.22 | 0.98 | 1.02 | 1.02 | 0.74 |
|  Tryptophan | 1.91 | 1.78 | 1.31 | 1.36 | 0.75 | 1.23 | 1.24 | 0.81 |
|  Valine | 1.73 | 1.72 | 1.81 | 1.80 | 1.28 | 1.31 | 1.25 | 1.10 |

WPI, whey protein isolate; WPC, whey protein concentrate; MPC, milk protein concentrate; SMP, skim milk powder; PPC, pea protein concentrate; SPI, soy protein isolate; AAA, aromatic amino acids (Phenylalanine + Tyrosine); SAA, sulfur amino acids (Methionine + Cysteine).

\*Values for PDCAA were calculated from the total tract digestibility of CP in pigs.

† PDCAA reference ratios were calculated using the recommended amino acid scoring pattern for preschool children (2 to 5 years). The indispensable amino acid reference patterns are expressed as mg amino acid /g protein: Histidine, 19; Isoleucine, 28; Leucine, 66; Lysine, 58; sulfur amino acids, 25; aromatic amino acids, 63; Threonine, 34; Tryptophan, 11; Valine, 35(1).

**Supplemental B.** Protein digestibility corrected amino acid (PDCAA) reference ratios for ingredients calculated according to requirement for infants (< 6 months), child (6 months to 3 years) and older child (> 3 years), adolescents, and adults\*

|  |  |
| --- | --- |
|  | Ingredient |
| Item | WPI | WPC | MPC | SMP | PPC | SPI | Soy flour | Wheat |
| PDCAA reference ratio, birth to 6 months† |  |  |  |  |  |  |  |  |
|  Histidine | 0.96 | 1.06 | 1.44 | 1.47 | 1.21 | 1.24 | 1.23 | 1.10 |
|  Isoleucine | 1.27 | 1.16 | 0.97 | 0.94 | 0.75 | 0.86 | 0.77 | 0.55 |
|  Leucine | 1.21 | 1.25 | 1.06 | 1.04 | 0.75 | 0.83 | 0.75 | 0.63 |
|  Lysine | 1.47 | 1.47 | 1.18 | 1.21 | 1.06 | 0.89 | 0.86 | 0.44 |
|  Sulfur amino acids | 1.45 | 1.44 | 1.03 | 0.95 | 0.60 | 0.73 | 0.79 | 1.08 |
|  Aromatic amino acids | 0.68 | 0.74 | 1.08 | 1.01 | 0.85 | 0.94 | 0.85 | 0.62 |
|  Threonine | 1.76 | 1.58 | 1.01 | 0.98 | 0.79 | 0.82 | 0.82 | 0.60 |
|  Tryptophan | 1.27 | 1.19 | 0.88 | 0.92 | 0.50 | 0.82 | 0.84 | 0.55 |
|  Valine | 1.13 | 1.13 | 1.19 | 1.19 | 0.84 | 0.87 | 0.83 | 0.73 |
| PDCAA reference ratio, 6 months to 3years‡ |  |  |  |  |  |  |  |  |
|  Histidine | 1.01 | 1.11 | 1.51 | 1.54 | 1.27 | 1.30 | 1.29 | 1.16 |
|  Isoleucine | 2.19 | 1.99 | 1.67 | 1.62 | 1.28 | 1.47 | 1.32 | 0.94 |
|  Leucine | 1.77 | 1.81 | 1.55 | 1.52 | 1.09 | 1.20 | 1.09 | 0.91 |
|  Lysine | 1.78 | 1.77 | 1.43 | 1.47 | 1.28 | 1.08 | 1.04 | 0.53 |
|  Sulfur amino acids | 1.78 | 1.76 | 1.25 | 1.16 | 0.74 | 0.89 | 0.97 | 1.32 |
|  Aromatic amino acids | 1.23 | 1.35 | 1.94 | 1.83 | 1.53 | 1.69 | 1.53 | 1.13 |
|  Threonine | 2.50 | 2.25 | 1.44 | 1.39 | 1.12 | 1.16 | 1.16 | 0.85 |
|  Tryptophan | 2.53 | 2.39 | 1.76 | 1.83 | 1.00 | 1.65 | 1.68 | 1.09 |
|  Valine | 1.45 | 1.45 | 1.52 | 1.52 | 1.08 | 1.11 | 1.06 | 0.93 |
| PDCAA reference ratio, 3 years and above§ |  |  |  |  |  |  |  |  |
|  Histidine | 1.26 | 1.39 | 1.88 | 1.93 | 1.59 | 1.62 | 1.61 | 1.45 |
|  Isoleucine | 2.33 | 2.13 | 1.78 | 1.73 | 1.37 | 1.57 | 1.41 | 1.00 |
|  Leucine | 1.91 | 1.96 | 1.67 | 1.64 | 1.18 | 1.30 | 1.18 | 0.99 |
|  Lysine | 2.12 | 2.11 | 1.69 | 1.74 | 1.52 | 1.28 | 1.24 | 0.63 |
|  Sulfur amino acids | 2.09 | 2.07 | 1.47 | 1.37 | 0.86 | 1.05 | 1.14 | 1.54 |
|  Aromatic amino acids | 1.56 | 1.71 | 2.47 | 2.33 | 1.94 | 2.15 | 1.94 | 1.43 |
|  Threonine | 3.09 | 2.78 | 1.79 | 1.73 | 1.38 | 1.44 | 1.44 | 1.05 |
|  Tryptophan | 3.26 | 3.07 | 2.26 | 2.36 | 1.29 | 2.12 | 2.16 | 1.40 |
|  Valine | 1.55 | 1.56 | 1.64 | 1.64 | 1.16 | 1.19 | 1.14 | 1.00 |

WPI, whey protein isolate; WPC, whey protein concentrate; MPC, milk protein concentrate; SMP, skim milk powder; PPC, pea protein concentrate; SPI, soy protein isolate; AAA, aromatic amino acids (Phenylalanine + Tyrosine); SAA, sulfur amino acids (Methionine + Cysteine).

\*Values for PDCAA were calculated from the total tract digestibility of CP in pigs.

† PDCAA reference ratios were calculated using the recommended amino acid scoring pattern for an infant (birth to 6 months). The indispensable amino acid reference patterns are expressed as mg amino acid /g protein: Histidine, 21; Isoleucine, 55; Leucine, 96; Lysine, 69; sulfur amino acids, 33; aromatic amino acids, 94; Threonine, 44; Tryptophan, 17; Valine, 55(8).

‡ PDCAA reference ratios were calculated using the recommended amino acid scoring pattern for a child (6 months to 3 years). The indispensable AA reference patterns are expressed as mg amino acid /g protein: Histidine, 20; Isoleucine, 32; Leucine, 66; Lysine, 57; sulfur amino acids, 27; aromatic amino acids, 52; Threonine, 31; Tryptophan, 8.5; Valine, 40(8).

§ PDCAA reference ratios were calculated using the recommended amino acid scoring pattern for older child, adolescent, and adult. The indispensable AA reference patterns are expressed as mg amino acid /g protein: Histidine, 16; Isoleucine, 30; Leucine, 61; Lysine, 48; sulfur amino acids, 23; aromatic amino acids, 41; Threonine, 25; Tryptophan, 6.6; Valine, 40(8).

**Supplemental C.** Digestible indispensable amino acid (DIAA) reference ratios for ingredients calculated according to requirement for infants (< 6 months), child (6 months to 3 years) and older child (> 3 years), adolescents, and adults\*

|  |  |
| --- | --- |
|  | Ingredient1 |
| Item | WPI | WPC | MPC | SMP | PPC | SPI | Soy flour | Wheat |
| DIAA reference ratio, Birth to 6 months† |  |  |  |  |  |  |  |  |
|  His | 0.95 | 1.02 | 1.41 | 1.38 | 1.18 | 1.20 | 1.20 | 1.04 |
|  Ile | 1.25 | 1.11 | 0.90 | 0.84 | 0.70 | 0.82 | 0.75 | 0.52 |
|  Leu | 1.20 | 1.21 | 1.04 | 0.98 | 0.71 | 0.79 | 0.73 | 0.60 |
|  Lys | 1.44 | 1.43 | 1.12 | 1.15 | 1.05 | 0.87 | 0.85 | 0.37 |
|  Sulphur amino acid | 1.42 | 1.37 | 0.97 | 0.86 | 0.51 | 0.68 | 0.73 | 1.04 |
|  Aromatic amino acid | 0.67 | 0.71 | 1.05 | 0.96 | 0.81 | 0.90 | 0.83 | 0.60 |
|  Thr | 1.65 | 1.43 | 0.94 | 0.81 | 0.72 | 0.76 | 0.76 | 0.53 |
|  Trp | 1.26 | 1.18 | 0.85 | 0.83 | 0.45 | 0.79 | 0.82 | 0.45 |
|  Val | 1.09 | 1.07 | 1.11 | 1.07 | 0.78 | 0.82 | 0.80 | 0.67 |
| DIAA reference ratio, 6 months to 3 years‡ |  |  |  |  |  |  |  |  |
|  His | 1.00 | 1.07 | 1.48 | 1.45 | 1.24 | 1.26 | 1.26 | 1.09 |
|  Ile | 2.15 | 1.91 | 1.55 | 1.44 | 1.21 | 1.41 | 1.29 | 0.89 |
|  Leu | 1.75 | 1.76 | 1.52 | 1.43 | 1.03 | 1.15 | 1.06 | 0.88 |
|  Lys | 1.75 | 1.73 | 1.36 | 1.40 | 1.27 | 1.05 | 1.03 | 0.45 |
|  Sulphur amino acid | 1.74 | 1.68 | 1.18 | 1.05 | 0.62 | 0.84 | 0.89 | 1.27 |
|  Aromatic amino acid | 1.21 | 1.28 | 1.89 | 1.74 | 1.46 | 1.63 | 1.50 | 1.09 |
|  Thr | 2.34 | 2.03 | 1.34 | 1.14 | 1.02 | 1.08 | 1.07 | 0.75 |
|  Trp | 2.52 | 2.36 | 1.70 | 1.66 | 0.90 | 1.58 | 1.64 | 0.90 |
|  Val | 1.40 | 1.36 | 1.43 | 1.37 | 0.99 | 1.05 | 1.03 | 0.85 |
| DIAA reference ratio, 3 years and above§ |  |  |  |  |  |  |  |  |
|  His | 1.25 | 1.33 | 1.85 | 1.81 | 1.55 | 1.57 | 1.57 | 1.37 |
|  Ile | 2.29 | 2.04 | 1.65 | 1.54 | 1.29 | 1.50 | 1.38 | 0.95 |
|  Leu | 1.89 | 1.90 | 1.64 | 1.55 | 1.12 | 1.24 | 1.14 | 0.95 |
|  Lys | 2.08 | 2.06 | 1.61 | 1.66 | 1.50 | 1.25 | 1.23 | 0.53 |
|  Sulphur amino acid | 2.04 | 1.97 | 1.39 | 1.24 | 0.73 | 0.98 | 1.05 | 1.49 |
|  Aromatic amino acid | 1.53 | 1.63 | 2.40 | 2.21 | 1.85 | 2.06 | 1.90 | 1.38 |
|  Thr | 2.90 | 2.52 | 1.66 | 1.42 | 1.26 | 1.33 | 1.33 | 0.93 |
|  Trp | 3.24 | 3.04 | 2.19 | 2.14 | 1.16 | 2.04 | 2.12 | 1.16 |
|  Val | 1.50 | 1.47 | 1.53 | 1.47 | 1.07 | 1.12 | 1.10 | 0.92 |

WPI, whey protein isolate; WPC, whey protein concentrate; MPC, milk protein concentrate; SMP, skim milk powder; PPC, pea protein concentrate; SPI, soy protein isolate; AAA, aromatic amino acids (Phe + Tyr); SAA, sulfur amino acids (Met + Cys).

\*Values for PDCAA were calculated from the total tract digestibility of CP in pigs.

† DIAA reference ratios and respective DIAAS were calculated using the recommended amino acid scoring pattern for an infant (birth to 6 months). The indispensable amino acid reference patterns are expressed as mg amino acid /g protein: His, 21; Ile, 55; Leu, 96; Lys, 69; sulphur amino acid, 33; aromatic amino acid, 94; Thr, 44; Trp, 17; Val, 55(8).

‡ DIAA reference ratios and respective DIAAS were calculated using the recommended amino acid scoring pattern for a child (6 months to 3 years). The indispensable AA reference patterns are expressed as mg amino acid /g protein: His, 20; Ile, 32; Leu, 66; Lys, 57; sulphur amino acid, 27; aromatic amino acid, 52; Thr, 31; Trp, 8.5; Val, 40(8).

§ DIAA reference ratios and respective DIAAS were calculated using the recommended amino acid scoring pattern for older child, adolescent, and adult. The indispensable AA reference patterns are expressed as mg amino acid /g protein: His, 16; Ile, 30; Leu, 61; Lys, 48; sulphur amino acid, 23; aromatic amino acid, 41; Thr, 25; Trp, 6.6; Val, 40(8).