Subject Index

A
N-Acetylenuraminic acid, 110–111
human milk, lactation changes, 111
Adapted whey formula, postprandial amino acid curve, 62
Alkaptonuria, 211
Allergy, 178
Alpha-lactalbumin, 128–129
cystine, 125
infant formula, 125–126
isoleucine, 125
leucine, 125
lysine, 125
methionine, 125
phenylalanine, 125
proteolysis, 58
threonine, 125
tryptophan, 125
valine, 125
American Academy of Pediatrics, protein requirement, recommendations, 177–178
Amino acid. See also Specific type central nervous system functions, 184
changing view of role, 1
cognitive outcome, 189
essentiality, 27
fetus, 100
functions, 3–4
large neutral, 187, 188
muscle, 130
nutritionally relevant, 1–4
oral administration, 46
pathways, 14
pattern changes, 187–190
protein requirement, 75–77
recommendations, 77
red blood cell, 194
sulfur-containing, 189–190
total parenteral nutrition, 100, 186
cystine, 186–187
tyrosine, 186–187
transport rate, 13
whole body protein turnover, 44
Amino acid conservation, 8
Amino acid homeostasis, principal metabolic systems, 4–13
integration, 13–23
Amino acid metabolism
biochemistry, cellular processes, 5
energy dependency, 20–23
qualitative aspects, 20, 21
quantitative aspects, 20–23
Michaelis constant, 9
physiology, cellular processes, 5
protein nutrition
biochemistry, 1–23
physiology, 1–23
Amino acid oxidation, 8–10
amino acid intake, 8–10
rate, 8
substrate availability, 8–10
tissue enzymes, 9–10
Amino acid requirement, 77
kinetic data, 83–84
Amino acid transport, 12–13
Amino alcohol, non-protein nitrogen, 113–114
Amino nitrogen, 11
Ammonia
human milk, 114
non-protein nitrogen, 114
urea cycle enzyme, 14
Anabolic drive, 6–7
Anorexia, tumor necrosis factor, 231–232
Anoxia, protein degradation, 47
alpha-Antitrypsin, human milk protein, 54
Arginine, 27
citrulline, 16–19
urea cycle enzyme, 14
Arginine kinetics, metabolic cooperativity, 13–19
Arginine metabolism
functional specialization, 17
intracellular compartmentation, 17
in vivo, 15

B
Baby food, protein content, 171
Bacterial flora, urea, 64
Balance study, 149
Bile salt binding, casein, 78
Binding protein, non-protein nitrogen, 117
Biologically active peptide
human milk, 112–113
non-protein nitrogen, 112–113
Body composition, 147
Bovine milk protein, proteolysis, 58
Bovine serum albumin, 129
SUBJECT INDEX

Brain, breast feeding, 131
Branched-chain amino acid
adequate intake, 215
breast feeding, 218
infant formula, 218
mature milk, 213
Branched-chain amino acid catabolism, 9–10
Branched-chain keto acid dehydrogenase, 10
Brazelton score
human milk, 192
infant formula, 192
Breast feeding. See also Breast milk
brain, 131
branched-chain amino acid, 218
consequences, 173–175
diabetes, 131
fecal flora, 78–79
insulin, 131
phenylalanine, 218
protein intake effect, 172–173
renal function, 131
Breast milk
N-acetylneuraminic acid, lactation
changes, 111
ammonia, 114
biologically active peptide, 112–113
Brazelton score, 192
carnitine, 114
choline, 113–114
consequences, 173–175
creatine, 114
creatinine, 114
essential amino acid, 225
fetal growth retardation, 102–103
fortifier, 64
IgA, 103
lactoferrin, 103
lysozyme, 103
maternal diet, 102
nitrogen, 225
non-protein nitrogen
characterization, 105–107
total nitrogen, 105
nucleic acid, 112
nucleotide, 112
parity, 130
polyamine, 112
preterm infant, 147–148
growth rates, 147–148
protein, 53–55, 87–103
amino acid content, 94–95
amino acid pattern, 121–127, 128–132
alpha-antitrypsin, 54
content variability, 163
cystine, 125
digestibility, 53–55
intake effect, 172–173
isoleucine, 125
lactoferrin, 54
leucine, 125
lysine, 125
methionine, 125
nutritional value, 91–94
by phases of lactation, 89–90
phenylalanine, 125
preterm infant, digestibility, 55
proteolysis, 58
qualitative aspects, 121–127, 128–132
secretory IgA, 53
threonine, 125
tryptophan, 125
valine, 125
urea, 101–102
uric acid, 114
Breast milk protein, secretory IgA, 54

C
Calcium, 182
casein, 78
Cancer patient, protein degradation, 46
Carbohydrate
large bowel, 64
nitrogen-containing, 110–112
Carbon-13 method, whole body protein turnover, 33–35
Carbon dioxide, urea cycle enzyme, 14
Carboxypeptidase, casein, 78
Carnitine, 118, 119
human milk, 114
non-protein nitrogen, 114
Casein
bile salt binding, 78
calcium, 78
carboxypeptidase, 78
enzyme, 63
gastric emptying, 78
infant formula, 116
iron, 78
lactobezoar formation, 78
milk, 91, 92
postprandial amino acid curve, 62
proteolysis, 58
Catabolic hormone, 232, 233
Catch-up growth
fat, 78
nitrogen, 78
protein requirement, 74–75, 141–143
Catecholamine metabolism, 193–194
Catecholamine synthesis, 188
Chicken-based formula, 119–120
Chlorine, 86
Cholesterol, phenylketonuria, 227
Choline
human milk, 113–114
non-protein nitrogen, 113–114
Chronic high lactose ingestion model, 209
Citric line, 18
arginine, 16–19
Cognitive outcome, amino acid, 189
Colostrum, 89–90
IgA, 103
lactoferrin, 103
lysozyme, 103
nucleotide, 210
Compartmentation, 27
Congenital heart disease, nucleotide, 47
Cow’s milk formula, 118
Cow’s milk protein adaptation to human milk, 121–122
modifying, 129
Creatine
human milk, 114
non-protein nitrogen, 114
Creatinine, 162, 181
human milk, 114
non-protein nitrogen, 114
Cystein sulfinic acid decarboxylase, 193
Cysteine, 118, 189, 193
protein requirement, 75
Cystine, 186–187
alpha-lactalbumin, 125
human milk protein, 125
whey protein, 125
whole bovine milk protein, 125
Cytokine, 229

D
Developing country, protein needs, 179–180, 182
Diabetes
breast feeding, 131
small for gestational age infant, 150
Diet protein, protein turnover, 43
Dietary nucleotide
absorption, 197–200
metabolism, 197–200
Dietary protein allowance, whole body protein synthesis, by age, 19
Digestibility
gastric emptying, 64
human milk protein, 53–55
Disaccharidase, nucleoside, 201, 202
Downregulation, 28

E
End product method, whole body protein turnover, 30–33
Energy turnover rate
protein degradation rate, 49–52
background, 49
methodological aspects, 49
RNA degradation rate, 49–52
background, 49
methodological aspects, 49
Enzyme, casein, 63
Epidermal growth factor
gut function, 117
non-protein nitrogen, 117
ESPGAN, protein requirement, recommendations, 177–178
Essential amino acid, 183–190, 192–194
breast milk, 225
proposed developmentally, 184
Essential amino acid requirement
computation methods, 212–218
direct estimation of net in vivo synthesis, 217–218
estimation for artificially fed infants, 213–215
factorial methods, 215–217
human milk model, 212–213
inborn errors of metabolism, 211–222, 225–227

F
Fat, 148–149
catch-up growth, 78
milk, 88
Fat globule protein, 118
Fat store, 146–147
Fecal excretion
lactoferrin, 92, 93
secretory IgA, 92, 93
Fecal flora
breast-fed baby, 78–79
infant formula, 78–79
Fetal growth retardation
breast milk, 102–103
insulin-like growth factor, 118
Fetus
amino acid, 100
serine, 101
Flooding method, protein turnover, 38–39
Follow-on formula, 83, 178
weaning, recommendations, 168–170

G
Gastric acid, output by age, 57
Gastric emptying
casein, 78
digestibility, 64
Gene transcription, 5
Genotype, phenylketonuria, 218–219
Glutamine, 208
parenteral nutrition, 46–47
septic shock, 46–47
Glutathione. 118
   red blood cell, 194
Glycine, premature infant, 194
Glycine turnover, neonate, 44
Glycosylation precursor, non-protein
   nitrogen, 117
Growth, variability, 161, 162
Growth data, protein requirement, 159-160
   factorial method, 160
   growth curves, 160
   WHO/FAO, 160-161
Gut closure, 118
Gut function
   epidermal growth factor, 117
   metabolic factors, 79-80
Gut microflora, 85
   nucleotide, 201

H
Heart rate, 162
Heat treatment
   lysine, 63
   serine, 63
   threonine, 63
Histidine, 1, 130
Human whey protein, 53-55
Hydrolysate formula, urea, 116
Hydrolyzed formula, 63-64
Hypercatabolic state, protein requirement,
   74
Hypernatremic dehydration, 179

I
IgA
   breast milk, 103
   colostrum, 103
   mature milk, 103
Immune system, nucleotide, 200-201
Inborn errors of metabolism, essential
   amino acid requirement, 211-222,
   225-227
Infant. See also Sick infant
   protein
   absorption, 53-65
   digestibility, 53-65
   infant nutrition, 59-60
   international recommendations, 67-86
Infant formula, 62. See also Specific type
   alpha-lactalbumin, 125-126
   branched-chain amino acid, 218
   Brazelton score, 192
   casein, 116
   consequences, 173-175
   cost, 131
   fecal flora, 78-79
   improved biological value, 125-126
   label claim, 83
   lower current level, 164
   non-protein nitrogen, 107-109, 116
   nucleotide, 209
   protein, 100
   amino acid pattern, 121-127, 128-132
   digestibility, 56-59
   heat treatment, 57
   intake effect, 172-173
   level, 56
   qualitative aspects, 121-127, 128-132
   protein requirement
      clinical studies, 156-158
      recommendations, 156
      reduced protein formulas, 156-158
      supplementation, 118
   Swedish experience, 158
   taurine, 209
   true protein level, 128
   urea, 116
   weaning, recommendations, 168-170
Infection
   neonate, 46
   nitrogen, 83
   protein requirement, 84
   Insulin, breast feeding, 131
   Insulin-like growth factor, fetal growth
      retardation, 118
   Insulin resistance, tumor necrosis factor,
      233-234
   Interorgan metabolic flow, membrane
      transport, 12
   Intestinal development, nucleotide, 201-203
   Intestinal injury, nucleotide, 209
   Intestinal repair, nucleotide, 201-203
   Intravenous feeding, whole body protein
      turnover, 44
   Iron, casein, 78
   Iron deficiency, 178
Isoleucine
   alpha-lactalbumin, 125
   human milk protein, 125
   whey protein, 125
   whole bovine milk protein, 125

K
Kidney, 181

L
Lactobacillus bifidus, 110-112
Lactobezoar formation, casein, 78
Lactoferrin
   breast milk, 103
   colostrum, 103
   fecal excretion, 92, 93
   human milk protein, 54
mature milk, 103
milk, 92, 93
proteolysis, 58
beta-Lactoglobulin, 129
Lactose, milk, 88
Lamb-based formula, 119
Large bowel, carbohydrate, 64
Leucine
alpha-lactalbumin, 125
genotype-phenotype correlation, 221–222
human milk protein, 125
kinetic method, 83–84
polysome profile, 43
variant classification, 221–222
whey protein, 125
whole bovine milk protein, 125
Leucine oxidation, 9, 10
Leucine requirement, 83–84, 225
Leucine turnover, neonate, 44
Leucinosis, 221–222
genotype-phenotype correlation, 221–222
leucine, 222
variant classification, 221–222
Linear growth, 161
Lipid protein interaction, 65
Liver, protein synthesis, 35, 36
Long-chain fatty acid, 65
Lophinalac, 227
Low birthweight infant, protein requirement, 133–141
Low protein diet, 162–163
Low protein intake, 85–86
Lysine, 1
alpha-lactalbumin, 125
heat treatment, 63
human milk protein, 125
whey protein, 125
whole bovine milk protein, 125
Lysozyme
breast milk, 103
colostrum, 103
mature milk, 103
nucleotide, 210
phenylalanine, 213
Medium-chain triglyceride, 65
Membrane transport
interorgan metabolic flow, 12
substrate utilization, 12
Metabolic cooperativity, arginine kinetics, 13–19
Metalloprotein, 131–132
Methionine
alpha-lactalbumin, 125
human milk protein, 125
whey protein, 125
whole bovine milk protein, 125
Michaelis constant, amino acid metabolism, 9
Milk. See also Specific type
casein, 91, 92
fat, 88
lactoferrin, 92, 93
lactose, 88
protein, 88
secretory IgA, 92, 93
whey protein, 91, 92
Milk protein fraction, changes during lactation, 90–91
Mineral absorption, 131–132
Muscle
amino acid, 130
protein synthesis, 35, 36, 44
N
Necrotizing enterocolitis, nucleotide, 208
Neonate
glycine turnover, 44
infection, 46
leucine turnover, 44
phenylalanine turnover, 44
Neuropsychological development, preterm infant, 130
Neurotransmitter precursor, 187
Nitrogen. See also Non-protein nitrogen
breast milk, 225
catch-up growth, 78
infection, 83
protein intake, 12
protein requirement, 77–78
net nutrient absorption, 77–78
Nitrogen-15 method, 116
whole body protein turnover, 30–33
ammonia, 32
end product average, 32
glycine, 31–32
in infants, 31
single dose of isotope, 31
urea, 32
Nitrogen balance study, 162
M
Malnutrition, protein turnover, 45
Mammalian milk, protein, comparative aspects, 87–89
Maternal diet
breast milk, 102
human milk, 102
milk volume, 102
taurine, 102
Mature milk, 89–90
branched-chain amino acid, 213
IgA, 103
lactoferrin, 103
lysozyme, 103
N
Neonate
glycine turnover, 44
infection, 46
leucine turnover, 44
phenylalanine turnover, 44
Neuropsychological development, preterm infant, 130
Neurotransmitter precursor, 187
Nitrogen. See also Non-protein nitrogen
breast milk, 225
catch-up growth, 78
infection, 83
protein intake, 12
protein requirement, 77–78
net nutrient absorption, 77–78
Nitrogen-15 method, 116
whole body protein turnover, 30–33
ammonia, 32
end product average, 32
glycine, 31–32
in infants, 31
single dose of isotope, 31
urea, 32
Nitrogen balance study, 162
Nitrogen-containing carbohydrate, 110–112
Non-essential amino acid, 183–190, 192–194
Non-protein nitrogen, 163
- amino alcohol, 113–114
- ammonia, 114
- binding protein, 117
- biological activity, 116–117
- biologically active peptide, 112–113
- breast milk
  - characterization, 105–107
  - total nitrogen, 105
- carnitine, 114
- choline, 113–114
- creatine, 114
- creatinine, 114
- epidermal growth factor, 117
- glycosylation precursor, 117
- infant formula, 107–109, 116
- nucleic acid, 112
- nucleotide, 112
- nutritional importance, 105–114, 116–120
- polyamine, 112
- urea, 109–110
- uric acid, 114
- whey formula, 116
- Nucleic acid, 203–206
  - human milk, 112
- non-protein nitrogen, 112
- Nucleoside, disaccharidase, 201, 202
- Nucleotide, 203–206
- absorption, 197–200
- bacteria, 208
- biological significance, 200–203
- colostrum, 210
- congenital heart disease, 47
- dietary sources, 210
- gut microflora, 201
- human milk, 112
- immune system, 200–201
- infant formula, 209
- intestinal development, 201–203
- intestinal injury, 209
- intestinal repair, 201–203
- mature milk, 210
- metabolism, 197–200
- necrotizing enterocolitis, 208
- non-protein nitrogen, 112
- radiation injury, 208, 210
- tissue growth, 203
- tissue repair, 203
- unsubstantiated claims, 208
- uric acid, 210
- Nucleotide requirement, 208–209

O
- Oral rehydration fluid, 179
- Ornithine, 18

P
- Parenteral nutrition, glutamine, 46–47
- Parity, breast milk, 130
- Partially hydrolyzed formula, 63–64
- Pepsin, output by age, 57
- Phenylalanine, 130–131, 193
  - adequate intake, 215
  - alpha-lactalbumin, 125
  - breast feeding, 218
  - enrichments, 38
  - human milk protein, 125
  - mature milk, 213
  - phenylketonuria, 218, 219–220, 221, 225
  - tyrosine, 225–226
  - whey protein, 125
  - whole bovine milk protein, 125
- Phenylalanine requirement, 225
- Phenylalanine turnover, neonate, 44
- Phenylketonuria, 218–220, 221
  - cholesterol, 227
  - genotypes/phenotypes, 218–219
  - long-term treatment, 226
  - phenylalanine, 218, 219–220, 221, 226
  - pregnancy, 227
  - variant classification, 218–219
- Plasma amino acid, 185–187
  - concentration, 8–9
- Plasma arginine flux, 16–19
- Plasma arginine kinetics, 13–19
- Plasma citrulline flux, 16–19
- Polyamine, 118
  - human milk, 112
  - non-protein nitrogen, 112
- Polysome profile, leucine, 43
- Postprandial amino acid curve
  - adapted whey formula, 62
  - casein, 62
- Potassium, 86
- Precursor method
  - protein synthesis, 44
  - whole body protein turnover, 33–35
- Pregnancy, phenylketonuria, 227
- Preterm breast milk, protein, 95–98
- Preterm infant, 100
  - glycine, 194
  - human milk, 147–148
  - growth rates, 147–148
  - human milk protein, digestibility, 55
  - neuropsychological development, 130
  - protein degradation, 46
tyrosine, 130
whole body protein turnover, 44

Protein
functional, 62–63
high intakes, 163
in early life, 122–124
human milk, 53–55, 87–103
amino acid content, 94–95
amino acid pattern, 121–127, 128–132
nutritional value, 91–94
by phases of lactation, 89–90
qualitative aspects, 121–127, 128–132
infant
absorption, 53–65
digestibility, 53–65
infant nutrition, 59–60
international recommendations, 67–86
infant formula, 100
amino acid pattern, 121–127, 128–132
digestibility, 56–59
heat treatment, 57
level, 56
qualitative aspects, 121–127, 128–132
intake
nitrogen, 12
type of milk feeding effects, 172–173
low intake in early life, 122–124
mammalian milk, comparative aspects, 87–89
milk, 88
preterm breast milk, 95–98
protective, 63
quality, 85
quantitative assessment, 62–63
true nutritional, 63
urea cycle enzyme, differing consumption levels, 11

Protein accretion, 146–147
Protein degradation, 7–8, 45
anoxia, 47
cancer patient, 46
major systems, 7
metabolic energy, 7–8
nutritional aspects, 7
premature infant, 46
refeeding after protein-energy malnutrition, 45
regulation, 7
sick infant, 46
site, 45
turnover, 7

Protein degradation rate
energy turnover rate, 49–52
background, 49
methodological aspects, 49
oxygen consumption, 49–52

Protein/energy ratio, weaning, 182
Protein/fat ratio, 148–149

Protein gap, 180
Protein homeostasis, principal metabolic systems, 4–13
integration, 13–23
Protein hydrolysate, 85
Protein loss, tumor necrosis factor, 230–231
Protein metabolism
biochemistry, cellular processes, 5
energy dependency, 20–23
qualitative aspects, 20, 21
quantitative aspects, 20–23
physiology, cellular processes, 5
protein nutrition
biochemistry, 1–23
physiology, 1–23
tumor necrosis factor, 229–236, 239–242

Protein nutrition
amino acid metabolism
biochemistry, 1–23
physiology, 1–23
protein metabolism
biochemistry, 1–23
physiology, 1–23

Protein requirement, 67–80
American Academy of Pediatrics, recommendations, 177–178
amino acid, 75–77
background, 67
catch-up growth, 74–75, 141–143
cysteine, 75
denominator, 69–75
energy of food, 69–70
environmental stress factors, 85
ESPGAN, recommendations, 177–178
foods, 67
growth data, 159–160
factorial method, 160
growth curves, 160
WHO/FAO, 160–161
hypercatabolic state, 74
individuals, 69
infant formula
clinical studies, 156–158
recommendations, 156
reduced protein formulas, 156–158
infection, 84
intestinal events, 77–80
label claim, 80
low birthweight infant, 133–141
minimum, 149
multiples of nitrogen, 68
nitrogen, 77–78
net nutrient absorption, 77–78
non-protein nitrogen, 68–69
numerator, 67–69
populations, 67
protein adequacy/excess indices, 137–141
Protein requirement (contd.)
protein/energy ratio
in pathological states, 74–75
in physiological states, 70, 71, 72
in weaning diets, 70–74
Scientific Committee for Food, recommendations, 177–178
small for gestational age infant, 144–145, 150
term infant
factorial method for estimation, 153–155
first four months, 153–158, 159–164
protein intake in growing breast-fed infants, 153
safe intake, 155
study methods, 153–155
tryptophan, 76–77
very low birthweight infant, 135, 143–144
blood urea nitrogen, 135
parenteral nutrition, 135
plasma amino acid, 136
urinary nitrogen excretion, 135
volume of food, 69–70
weaning, 165–175, 177–182
recommendations, 165–168
weight, 69
weight of food, 69–70
Protein synthesis
cellular origin of amino acids, 37
downregulating transport precursors, 43
enzyme, 28
flooding, 43
initiation complex, 5, 6
liver, 35, 36
modifications in phosphorylation state, 5–6
muscle, 35, 36, 44
precursor method, 44
regulation site, 5–6
site, 44
transcriptional phase, amino acid defect, 6
translational aspects, 5–7.
Protein turnover
constant infusion of labeled amino acids, 36–38
diet protein, 43
flooding method, 38–39
individual tissues, 35–39
isotopic study methods, 29–40
levels, 42–43
malnutrition, 45
nutritional implications, 19–20
quantitative aspects, 19–20
rate, 28
sick infant, 46
urea labeling study, 46
Proteolysis
bovine milk protein, 58
casein, 58
human milk protein, 58
alpha-lactalbumin, 58
lactoferrin, 58
Purine, 208
Purine base precursor, 198
Pyrimidine base precursor, 198
R
Radiation injury, nucleotide, 208, 210
Recombinant glycosylated protein, 117
Red blood cell
amino acid, 194
glutathione, 194
Refeeding after protein-energy malnutrition, protein degradation, 45
Renal acid excretion, 147
Renal disease, 181
Renal function, breast feeding, 131
Resting metabolic rate, whole body protein turnover, 22, 23
Retinopathy of prematurity, taurine, 194
RNA degradation rate
energy turnover rate, 49–52
background, 49
methodological aspects, 49
oxygen consumption, 49–52
S
Scientific Committee for Food, protein requirement, recommendations, 177–178
Secretory IgA
fecal excretion, 92, 93
human milk protein, 53, 54
milk, 92, 93
Selenium, 118
Selenocysteine, 1–2
Septic shock, glutamine, 46–47
Serine
fetus, 101
heat treatment, 63
Serine synthesis, 27–28
Sialic acid, 119
Sick infant
protein degradation, 46
protein turnover, 46
Skeletal muscle, enzyme, 28
Small for gestational age infant
diabetes, 150
protein requirement, 144–145, 150
Soy formula, 119
<table>
<thead>
<tr>
<th>Subject</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substrate utilization, membrane transport.</td>
<td>12</td>
</tr>
<tr>
<td>Supplementary food, weaning.</td>
<td>170–172</td>
</tr>
<tr>
<td><strong>T</strong></td>
<td></td>
</tr>
<tr>
<td>Taurine</td>
<td>118, 129, 189, 192–193</td>
</tr>
<tr>
<td>infant formula</td>
<td>209</td>
</tr>
<tr>
<td>maternal diet</td>
<td>102</td>
</tr>
<tr>
<td>retinopathy of prematurity</td>
<td>194</td>
</tr>
<tr>
<td>vegetarian diet</td>
<td>193</td>
</tr>
<tr>
<td>Term infant, protein requirement</td>
<td></td>
</tr>
<tr>
<td>factorial method for estimation</td>
<td>153–155</td>
</tr>
<tr>
<td>first four months</td>
<td>153–158, 159–164</td>
</tr>
<tr>
<td>protein intake in growing breast-fed infants</td>
<td>153</td>
</tr>
<tr>
<td>safe intake</td>
<td>155</td>
</tr>
<tr>
<td>study methods</td>
<td>153–155</td>
</tr>
<tr>
<td>Threonine</td>
<td>44</td>
</tr>
<tr>
<td>alpha-lactalbumin</td>
<td>125</td>
</tr>
<tr>
<td>heat treatment</td>
<td>63</td>
</tr>
<tr>
<td>human milk protein</td>
<td>125</td>
</tr>
<tr>
<td>whey protein</td>
<td>125</td>
</tr>
<tr>
<td>whole bovine milk protein</td>
<td>125</td>
</tr>
<tr>
<td>Tissue growth, nucleotide</td>
<td>203</td>
</tr>
<tr>
<td>Tissue repair, nucleotide</td>
<td>203</td>
</tr>
<tr>
<td>Total parenteral nutrition</td>
<td></td>
</tr>
<tr>
<td>amino acid</td>
<td>100, 186</td>
</tr>
<tr>
<td>cystine</td>
<td>186–187</td>
</tr>
<tr>
<td>tyrosine</td>
<td>186–187</td>
</tr>
<tr>
<td>Tracer substance</td>
<td>45–46</td>
</tr>
<tr>
<td>Transitional milk</td>
<td>89–90</td>
</tr>
<tr>
<td>Tryptophan</td>
<td>1, 118, 189</td>
</tr>
<tr>
<td>alpha-lactalbumin</td>
<td>125</td>
</tr>
<tr>
<td>human milk protein</td>
<td>125</td>
</tr>
<tr>
<td>measurements</td>
<td>85</td>
</tr>
<tr>
<td>protein requirement</td>
<td>76–77</td>
</tr>
<tr>
<td>supplementation</td>
<td>128</td>
</tr>
<tr>
<td>whey protein</td>
<td>125</td>
</tr>
<tr>
<td>whole bovine milk protein</td>
<td>125</td>
</tr>
<tr>
<td>Tumor necrosis factor</td>
<td></td>
</tr>
<tr>
<td>anorexia</td>
<td>231–232</td>
</tr>
<tr>
<td>biochemistry</td>
<td>230</td>
</tr>
<tr>
<td>insulin resistance</td>
<td>233–234</td>
</tr>
<tr>
<td>metabolic effects of chronic exposure</td>
<td>230–234</td>
</tr>
<tr>
<td>production</td>
<td>230</td>
</tr>
<tr>
<td>protein loss</td>
<td>230–231</td>
</tr>
<tr>
<td>protein metabolism</td>
<td>229–236, 239–242</td>
</tr>
<tr>
<td>tolerance</td>
<td>234</td>
</tr>
<tr>
<td>tumors</td>
<td>234</td>
</tr>
<tr>
<td>Tyrosine</td>
<td>186–187, 188</td>
</tr>
<tr>
<td>phenylalanine</td>
<td>225–226</td>
</tr>
<tr>
<td>preterm infant</td>
<td>130</td>
</tr>
<tr>
<td>route of administration</td>
<td>186</td>
</tr>
<tr>
<td>Tyrosinosine</td>
<td>130</td>
</tr>
<tr>
<td><strong>U</strong></td>
<td></td>
</tr>
<tr>
<td>UGA codon</td>
<td>1–2</td>
</tr>
<tr>
<td>Upregulation</td>
<td>28</td>
</tr>
<tr>
<td>Urea</td>
<td></td>
</tr>
<tr>
<td>bacterial flora</td>
<td>64</td>
</tr>
<tr>
<td>human milk</td>
<td>101–102</td>
</tr>
<tr>
<td>hydrolysate formula</td>
<td>116</td>
</tr>
<tr>
<td>infant formula</td>
<td>116</td>
</tr>
<tr>
<td>non-protein nitrogen</td>
<td>109–110</td>
</tr>
<tr>
<td>urea cycle enzyme</td>
<td>14</td>
</tr>
<tr>
<td>Urea cycle arginine</td>
<td>18</td>
</tr>
<tr>
<td>Urea cycle enzyme</td>
<td>11–12</td>
</tr>
<tr>
<td>ammonia</td>
<td>14</td>
</tr>
<tr>
<td>arginine</td>
<td>14</td>
</tr>
<tr>
<td>carbon dioxide</td>
<td>14</td>
</tr>
<tr>
<td>ornithine</td>
<td>14</td>
</tr>
<tr>
<td>protein, differing consumption levels</td>
<td>11</td>
</tr>
<tr>
<td>urea</td>
<td>14</td>
</tr>
<tr>
<td>Urea labeling study</td>
<td></td>
</tr>
<tr>
<td>protein turnover</td>
<td>46</td>
</tr>
<tr>
<td>Urea production</td>
<td>11–12</td>
</tr>
<tr>
<td>Uric acid</td>
<td></td>
</tr>
<tr>
<td>human milk</td>
<td>114</td>
</tr>
<tr>
<td>non-protein nitrogen</td>
<td>114</td>
</tr>
<tr>
<td>nucleotide</td>
<td>210</td>
</tr>
<tr>
<td>Urinary potassium excretion</td>
<td>147</td>
</tr>
<tr>
<td><strong>V</strong></td>
<td></td>
</tr>
<tr>
<td>Valine</td>
<td>189</td>
</tr>
<tr>
<td>alpha-lactalbumin</td>
<td>125</td>
</tr>
<tr>
<td>human milk protein</td>
<td>125</td>
</tr>
<tr>
<td>whey protein</td>
<td>125</td>
</tr>
<tr>
<td>whole bovine milk protein</td>
<td>125</td>
</tr>
<tr>
<td>Vegetarian diet</td>
<td></td>
</tr>
<tr>
<td>taurine</td>
<td>193</td>
</tr>
<tr>
<td>zinc</td>
<td>193</td>
</tr>
<tr>
<td>Very low birthweight infant, protein requirement</td>
<td>135, 143–144</td>
</tr>
<tr>
<td>blood urea nitrogen</td>
<td>135</td>
</tr>
<tr>
<td>parenteral nutrition</td>
<td>135</td>
</tr>
<tr>
<td>plasma amino acid</td>
<td>136</td>
</tr>
<tr>
<td>urinary nitrogen excretion</td>
<td>135</td>
</tr>
<tr>
<td>Vitamin B-6</td>
<td>194</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>86</td>
</tr>
<tr>
<td><strong>W</strong></td>
<td></td>
</tr>
<tr>
<td>Weaning</td>
<td></td>
</tr>
<tr>
<td>follow-on formula, recommendations</td>
<td>168–170</td>
</tr>
<tr>
<td>food</td>
<td>84</td>
</tr>
<tr>
<td>infant formula, recommendations</td>
<td>168–170</td>
</tr>
<tr>
<td>protein/energy ratio</td>
<td>182</td>
</tr>
<tr>
<td>protein requirement</td>
<td>165–175, 177–182</td>
</tr>
<tr>
<td>recommendations</td>
<td>165–168</td>
</tr>
<tr>
<td>solid foods</td>
<td>178</td>
</tr>
<tr>
<td>supplementary food</td>
<td>170–172</td>
</tr>
</tbody>
</table>
Weight gain, 150
Whey formula, 62
  non-protein nitrogen, 116
Whey protein
  cystine, 125
  isoleucine, 125
  leucine, 125
  lysine, 125
  methionine, 125
  milk, 91, 92
  phenylalanine, 125
  threonine, 125
  tryptophan, 125
  valine, 125
Whole body protein metabolism, 30
Whole body protein synthesis, dietary
  protein allowance, by age, 19
Whole body protein turnover
  amino acid, 44
  carbon-13 method, 33–35
  end product method, 30–33
  intravenous feeding, 44
  nitrogen-15 method, 30–33
  ammonia, 32
end product average, 32
  glycine, 31–32
  in infants, 31
  single dose of isotope, 31
  urea, 32
precursor method, 33–35
preterm infant, 44
resting metabolic rate, 22, 23
studies, 29–35
Whole bovine milk protein
  cystine, 125
  isoleucine, 125
  leucine, 125
  lysine, 125
  methionine, 125
  phenylalanine, 125
  threonine, 125
  tryptophan, 125
  valine, 125
Z
Zinc, 86
vegetarian diet, 193