# Index

acidity. *See also* pH  
- apparent, 344  
- developed, 344  
- titratable, 221, 244  
acidophilus milk, 393, 394, 403, 404  
- history, 403–404  
- microbiology, 405  
- production of sweet acidophilus milk, 404–405  
acidity for fruit preparations, 206  
adulteration, 38  
- affective test, 357, 358  
- focus group, 358, 359  
- just right intensity, 364  
- nine-point hedonic scale, 359  
agitation, 46  
- agitation of mix, 385  
- analytical tests, 357  
anticarcinogenesis, 427  
aseptic packaging, 171–173  
bacteriophages, 117  
- characteristics, 124  
- control of, 125–127  
- effect on cultured product, 116  
- resistance mechanisms, 126–127  
- starters, 115, 123  
- types of, 124  
bactofugation, 103, 104  
balance tank, 108  
basic dairy processing principles, 95–113  
- batch blending system, 76  
- batch pasteurization, 103  
- batch processes, 107–108  
- beneficial microflora, 423–424  
- *Bifidobacterium*, 251, 455  
- isolation and enumeration, 455  
*Bifidobacterium* spp., 394, 406  
bioactive dairy ingredients, 415  
bioactive peptides, 419, 420  
boiling point, 18  
booster pump, 109  
brix, 201, 202, 205  
Bulgarian milk/buttermilk, 395, 407  
buttermilk, 435  
buttermilk, cultured, 371–379  
buttermilk powder, 184  
buttermilk sales trend, 12, 13  
*Candida* spp., 401  
- caseinates, 187  
- casein fractions, 29, 417  
- catalase, 115  
- category scale, 359  
- cavitation, 99  
- centrifugal, 28  
- chakka, 18  
- chakka and shrikhand  
  - composition, 307, 308  
  - dessert/snack, 305  
  - dry products, 308–309  
  - industrial production, 307  
  - manufacturing process, 306–307  
  - packaging, 307  
  - preparation, 305–306  
  - quarg separator, 301, 307  
cholesterol, 25  
  - citrate-fermenting bacteria, 375, 386  
clarification, 103  
- cleaning, 52, 55  
- code dating, 89  
- Code of Federal Regulations, 71  
  - State preemption, 80  
- Codex standards, 89–91  
  - fermented milks, 89–90  
  - additives, 91  
  - composition, 90  
  - cultures, 90  
cold separation, 28  
- color, milk, 40  
- colors, 205, 215  
composition and specifications of dairy ingredients, 177–178  
- concurrent, 101, 102  
- condensed milk, 183–184, 220  
- contents, v  
- continuous mixing systems, 103  
- continuous pasteurization, 108  
- contributors, xi
Index

cooling, 14, 32, 52, 95–96, 100–102, 110

countercurrent, 101, 102
cream, 181
cream separation, 28
culture bacteria, 329
culture containing milk, 393–409
cultured buttermilk, 371–379, 435
  key steps in manufacture, 372
  breaking, cooling and distribution, 376
  buttermilk starter culture, 374–376
  flavor, body and texture, 377–378
  milk supply, 373
  processing of milk, 374
  sensory evaluation, 376
cultured cream sales trend, 14
cultured/sour cream, 381–390, 435
  body and texture, 386–387
  early history, 381
  filled sour cream, 389–390
  flavor defects, 387–388
  manufacturing procedure, 384
  present standards, 383
  problems and corrections, 386
  sour cream products, 388–390
curd tension, 39
dahi, 8, 17, 130, 393, 436
  history, 395–396
  microbiology, 398–399
  production, 396–397
  quality, 398
dairy foods production, United States, 6
dairy ingredients, 177, 217
  composition, 177, 218–219
  origin, 217
  performance in yogurt formulation, 178
dairy processing principles, 95–113
  overview of dairy processing equipment, 99
  centrifugal operations, 105
  centrifugal pump, 99
  from farm to factory, 95
  heat transfer operations, 100–101
  homogenization, 110–111
  membrane technology, 86–87, 111–113
  microbial transformation, 105
  mixing operations, 103
  positive displacement pump, 100
  separation, 103
  storage, raw milk, 96–98
  thermal processing systems, 107–110
density, 41
dermatitis, 427
descriptive, 358
  flavor profile, 358
  panelist selection, 358
  quantitative, 358
  scale usage, 358
  spectrum technique, 358
  texture profiling, 364
  training, 358
diacetyl, 119, 134–136
diarrhea, prevention, 427
difference, 358
  attribute, 357
  paired comparison, 357, 358
  ranking, 358
direct acidification, 383
discrimination tests, 357
  duo-trio, 357
  triangle, 357
drinkable yogurt, 359
dual-stage, 110
electrical conductivity, 44
equipment, 65
  3A sanitary standards, 64
  exopolysaccharides (EPS), 125, 136
farm requirements, 52
  barns, 52
  milking, 52
  milking equipment, 52
fat free sour cream, 389
fat globules, 182
fat globule size, 25
fermentation, 14, 115
fermentation vessels, 381–385
fermented dairy packaging materials, 149–174
fermented milk, 89, 360, 393–397, 433, 435
  additives, 91
  composition, 91
  consumption, 8
  culture containing milk, 393–397
  cultures, 8, 10, 90, 436
  forms, 9, 11
  middle east, 16, 438
  origin, 439
  packaging, 168–171
  Russia/eastern Europe, 16, 435
  Scandinavia, 15, 437
  South Asia, 17, 436
  world production, 7, 8
filled sour cream, 389
flavor defects, 387
flavoring, 73, 74, 75, 81, 89
flavor, milk, 61
flavors
  fruit, 205
  preparation, 205
  vanilla, 204
flow controller, 108, 109
flow diversion valve, 108
foaming, 96
food additives, 79, 91
Food and Drug Administration (FDA), 201, 206–207, 211, 232, 287, 288, 294, 331–332
fortification, 429
free fatty acids, 179, 273
freezing point, 57
fromage frais
cultured dairy products, 312–313
description, 312
fat contents, 312, 314
fruit and other flavors, 314
skim milk, 314
themoquarg process, 311, 314
thermization, 314
fruit preparations, 195–215
acidulants, 206
aseptic process, 210
banana, 199
blueberries, 198
cherry, 199
flavors, 208
formulation, 200
high intensity sweeteners, 201
hot kettle process, 209
organic, 199, 207
packaging, 213
peaches, 199
pectin, 203
preservatives, 206
processing, 209
quality checks, 342
raspberries, 198
raw materials, 196
specifications, 201
stabilizers, 203
strawberries, 198
sweeteners, 201
functional foods/disease prevention, 413–430
beneficial microflora, 423
bioactive dairy ingredients, 415, 419
bioactive peptides, 420
casein fractions, 417
lactose, 421, 440
lactose malabsorption, 443
milk fat, 421, 442
milk proteins, 415, 441
nutritional profile of yogurt, 417
nutritional value, 418
physiological effects, 419, 444
probiotics, 422
anticarcinogenesis, 427, 445
calcium, 426
fortification, 429
health benefits, 424
immunomodulatory role, 427, 447
manufacture, 428
mode of action, 425
physiological effects, 444
physiologically active ingredients, 429
prevention of diarrhea, vaginitis, dermatitis, 427
production of enzymes and vitamins, 426
reduction in serum cholesterol, 446
whey proteins, 417
functional properties of milk constituents, 419
gelatin, 234
Geotrichum candidum, 119, 401, 408
Grade “A” PMO, 51, 72
labeling, 60
standards, 61, 62, 63
grading, 353
USDA quality approval rating, 353, 355
Greek-style yogurt products
centrifugation
lebaneh production, 300
soft-cheese manufacture, 299
spray-nozzle, 300–301
membrane filtration
acetaldehyde, 305
acidification process, 304
cultured-dairy-products, 303
denatured whey proteins, 304
heat treatment, 304
manufacture, 303
methods, 302
microbial counts, 305
microfiltration (MF), 302
nanofiltration (NF), 301–302
reverse osmosis (RO), 301
separation capacity, 302
skim milk, 303–304
ultrafiltration (UF), 302, 305
whey protein, 305
nutritional values, 297, 298
strained, 299
HACCP, 58
prerequisite program, 59
Health Attributes of Yogurt and Fermented Milks, 433–448. See also health benefits
health benefits, 411, 413–415, 423, 438, 448
anticarcinogenic, 463
antimutagenic, 462
beneficial effects, 440
bio-yogurt, 448
Helicobacter pylori infection, 464
immune system stimulation, 465
inflammatory bowel disease, 465
kefir, 448
lactose metabolism, 440, 461
nordic fermented milks, 447
nutritional value, 438
reduction in serum cholesterol, 464
heat exchanger, 65
Index

heating, 11
heterofermentative, 119, 137
High Temperature Short Time Pasteurization (HTST), 18
history and consumption trends, 3
holding tube, 109
homofermentative, 121
homogenization, 29, 182, 274, 384–386
homogenizer, 110
immunomodulatory role, 427
ingredients, 217
acesulfame-K, 231
aspartame, 202, 230
condensed skim milk, 220
dairy, 177, 217
composition, 219
gelatin, 234
gums and pectins, 235
milk protein concentrate/ultrafiltered milk, 223
neotame, 231
nonfat dry milk, 220
saccharin, 230
stabilizers, 233, 234
starch, 234
sucralose, 232
sweeteners
corn, 227
high intensity, 202, 229
nutritive, 224
whey solids, 221
yogurt manufacture, 217–236
in-line standardization, 106, 107
international dairy federation, 347
international standards, 89
interstate commerce, 80
judging, 353, 354
kefir, 10, 16, 92, 119, 393–394, 399
description, 400
grains, 393, 400–402
history, 399
microbiology, 401, 402
production, 399–402
quality, 400–401
keldermilk, 15
kishk, 17
kosher, 88–89
koumiss, 10, 16, 92, 393–394, 399
description, 402
history, 402
microbiology, 403
production, 402
quality, 406
laban, 438
laban rayeb, 16
labeling, 80, 334
flavors, 81–83
information panel, 81
ingredients, 83
nomenclature, 73–77
nutrient claims, 336–338
nutrition, 85
daily reference values, 85, 335
format, 87
principal display panel, 80–81
serving size, 85
standard of identity, 81
labneh, 17, 360, 361
laboratory analysis of, 345
lactic acid bacteria, 125
taxonomy, 451–452
Lactobacillus, 140–142, 394, 401, 405–406, 455
acidophilus, 141, 142, 394, 403, 404, 405
brevis, 401
casei subsp. casei, 128
delbrueckii subsp. bulgaricus, 122, 128, 138, 139
subsp. lactis, 128
helveticus, 128, 407–408
kefir, 401
kefiranfaciens, 401
Lactococcus, 130, 401
lactis, 119
subsp. cremoris, 122, 128, 408
subsp. lactis, 122, 128
subsp. lactis (Cit+), 119, 120, 128, 136
lactose, 35, 36, 37, 421, 423
α-lactose, 35
β-lactose, 35
lactose, tests for, 120
HPLC method, 121
polarimetric method, 12
langfil, 15
lassi, 14
Leuconostoc, 134, 401
line scale, 359
lipolysis, 304
Listeria monocytogenes, 122
Long Time Low Temperature (LTLT), 108
low fat sour cream, 388–389
MacConkey glucose agar, 124
manufacture of various types of yogurt, 263–295.
See also yogurt, manufacture
mastitis, 35
membrane fouling, 37
membrane technology, 111
mesophilic microorganisms, 19
MF. See microfiltration (MF)
microbiological tests, 215, 340. See also analysis
microfiltration (MF), 25, 302
microorganisms, 10
microscope view of cultures, 139, 140, 141
  bifidobacteria, 252
  Lactobacillus acidophilus, 141, 249
  Lactobacillus delbrueckii spp. bulgaricus, 139, 267
  Streptococcus thermophilus, 139, 246
yogurt culture, 141, 241
milk, 3, 177
  composition, 11, 178, 180
    breed, 180–181
    camel, 10
    constituents, 21
    donkey, 10
    genetic variant, 27
    goat, 10
    mare, 10
    season, 198
    sheep, 10
    species, 178
    yak, 10
  composition, physical and processing characteristics, 17
  definition, 17
  functional properties, 316
  minor constituents, 30
  nutritional composition, 313
  physical characteristics, 31
  physical structure, 18–19
milk and milk based dairy ingredients, 167–178
milk enzymes, 34
  alkaline phosphates, 34
  lactoperoxidase, 34
  lipoprotein lipase, 34
  lysozyme, 34
  plasmin, 34
  protease, 34
milk fat, 24, 421
  fatty acid profile, 27
milk fat globule, 24, 25
  membrane, 25
  size distribution, 25
milk powder, 177
  composition, 177
  high heat, 178
  low heat, 178
  medium heat, 178
  whey protein nitrogen index, 177
milk pricing, 65
  classification, 65
  component, 65
  producer, 66–67
milk production, 3
  United States, 3, 4
  world, 3, 4, 11
milk protein concentrates, 184, 223
milk proteins, 416–417, 441, 442
  biologically active, 413
caseins, 30, 416–417
  composition, 31, 416
  functional aspects, 414
  isoelectric point, 118
  nutritional value, 418
milk safety, 50
  history, 50
  imports, 61
  inspections, 51
    check rating, 52
    compliance ratings, 52
milk transportation, 53–54, 58
  delivery, 58
  hauler, 53
  shipping information, 58
  trucks, 53
minerals, 35
  partition in milk, 35
mishti doi (dahi), 17
  definition, 315
  leuconostocs, 315
  milk fat, 315
  process, 315, 316
  starter culture, 315, 317
  varieties, 317
mixing, 9
Mycoderma spp., 403
nanofiltration (NF), 111
National Conference on Interstate Milk Shipments, 51, 59, 61, 63
National Yogurt Association, 77, 88
NF. See nanofiltration (NF)
onfat dry milk, 220
  composition, grade a, 221
  heat treatment classification, 221
  standards, 179, 221
  nutritional function, 440
  nutritional profile of yogurt, 417
  nutritional value, 440, 441
official methods of analysis, 61
organic, 207
organoleptic, 215
osmotic pressure, 41, 196
oxidation-reduction potential, 39
package in product distribution, 162–163
packaging, 55, 58, 79, 149–174
  biodegradability, 168
  definition, 150
  distribution, 150
  economics, 164
  environment, 166
  fundamentals, 150
  future trends, 174
  graphic design assessment, 140, 163–164
packaging (cont’d)
graphics, 151
interactions with product, 160–162
primary, 150
recycling, 167
regulation, 165
secondary, 150
structural design, 151
technology, 151
packaging for yogurt and fermented
milks, 168
packaging levels, 154
converters, 155
distributors, 156
equipment, 156
packagers, 156
packaging developments, 156–158
raw material suppliers, 155
resources available, 136–137, 158–160
packaging materials, 151
glass, 152
metal, 152
oxygen-barrier materials, 154
paper and paperboard, 151–152
plastic, 153, 264
polyester, 153
polyethylene, 153
packaging sour cream, 382, 389, 390
containers, 382
hot packaging, 382
paring disc, 105, 106
pasteurization, 56, 75, 78
pH, 240, 253, 254, 257, 276, 278, 283, 284, 288,
292, 293
indicator, 340–341
phage infection protein, 126
phage inhibitory media, 125
phosphatase, 108
phospholipids, 24–25
physical properties of milk, 37
acidity, titratable, 37
buffering capacity, 37
color, 40
density, 41
electrical conductivity, 44
flavor/off flavor, 39, 183, 265, 351
oxidation-reduction potential, 39
refractivity, 40–41
rheological, 42–43
specific gravity, 122
thermal, 44
physiological effects, 419, 444, 447, 463
anticancer effects, 445, 463
antimutagenic, 462
diarrhea, 424, 460
*Helicobacter pylori* infection, 464
immune system stimulation, 447, 465
irritable bowel disease, 465
lactose metabolism, 461
reduction in serum cholesterol, 446, 464
physiologically active ingredients, 429–430
plasmids, 120–121
plate heat exchangers, 96, 101, 108
*Podoviridae*, 124, 125
positive displacement, 100
positive lobe, 100
precipitation, 29–30, 32, 38
preference mapping, 359
preference testing, 359
preservatives, 75, 91, 206
pressure differential meter, 109
principles of yogurt processing, 239–260
probiotic milks, 393, 405, 422, 451
history, 406
production, 406
quality, 406
probiotics, 422, 424, 451, 453
health benefits, 422, 424, 459
manufacture, 428
mode of health benefits, 425
requirements for effective, 425
probiotics and fermented milks, 451–465
beneficial effects of probiotics, 424 (See also
probiotics, health benefits)
anticarcinogenic, 463
antimicrobial activity, 460
antimutagenic, 462
diarrhea, effective against, 460
commercial probiotic strains, 458
genus *bifidobacterium*, 455–457
isolation and enumeration, 457
genus *lactobacillus*, 453, 457
isolation and enumeration, 455
*Helicobacter pylori* infection, 464
immune system stimulation, 465
inflammatory bowel disease, 465
lactose intolerance, 461–462
physiological effects, 444
probiotic bacteria, 452–453
reduction in serum cholesterol, 464
selection criteria, 453
strains with peer reviewed clinical trials, 458
processing plants, 54
construction, 54
equipment, 55
processing principles, 95–113
protein adsorption, 110
proteins, minimum requirements, 418
nutritional values, 418
*Pseudomonas* spp., 120
pumps, 56
quality assurance, yogurt plant, 331
analytical tests, 340
daily reference values, 87
defects in yogurt and causes, 351
Food and Drug Administration, 331
food labeling, 334
nutrient claims, 336–338
nutrition facts label, 340
quality control programs, 341–342
compositional analysis, 345
criteria for live and active yogurt, NYA, 88
microbiological, 345
overrun, 346
quality tests, 343
sensory, 345
shelf life test, 344
viscosity, 345
regulatory obligations, 331
specification program, 348
process and product specification, 350
raw milk quality, 348
trouble shooting, 350
weight control, 350
quality-based method, 356
quarg
concentrated coagulum, 310
lactic curd product, 309
mesophilic starter cultures, 309–310
separator and UF processes, 312, 314
skim milk, 309
thermoquarg process, 310, 311
UF, 312, 313
raw milk, 4
Real Seal, 88
refractivity, 40
refrigeration, 14, 102
regulations for product standards and labeling, 71
regulatory requirements for milk production, transportation and processing, 49
rennet (use in sour cream), 382, 385
rennet coagulation, 35–36
representative sample, 96
restriction-modification, 126
reverse osmosis (RO), 111, 301
RO. See reverse osmosis (RO)
sampling, 63
sediment, 96
sensory analysis of yogurt, 359
attributes and references, 361
judging criteria, 355
quality terms, 356
sensory analysis techniques, 353
sensory descriptors, 360
USDA quality guidelines, 355
sensory evaluation, 353, 362
appearance, 357, 364
consistency, 357
flavor, 357, 364
odor, 364
taste, 364
texture, 364
separation, 15
serum cholesterol reduction, 427
shelf stable packaging, 170–171
aseptic packaging, 171
post-fill retorting, 171
shrikhand, 9, 18
silo, 65
single service containers, 56, 60
single-stage, 110, 111
Siphoviridae, 124
skyr, 9, 15–16, 395, 407–408, 437
smoothing screen, 386
sour cream, 381–390
sour cream cultures, 381, 384, 386
sour cream history, 381–383
soy milk yogurt, 363
specific gravity, 41, 239
spiral wound, 112
stabilizers, 73, 75, 91, 233, 382, 383, 386
in yogurt, 234
pectin, 235
Standardization, 105
Standardization standards, 383, 388–389
Standard Methods for the Examination of Dairy Products, 61
standards of identity, 71–72
cream, 72
cultured milk, 72–73
milk, 72
sour cream, 74
stayed provisions, 75
yogurt, 74–76
starch, native/modified, 234–235
starter culture
characteristics, 131, 132
definition of, 115
factors affecting, 117, 120–127
functions of, 116, 120, 129
miscellaneous, 146
production of, 142–146
types of, 124
yogurt and fermented milks, 115–147
Stokes law, 28
Streptococcus, 138, 244
thermophilus, 122, 123, 138
surface activity, 29
surface concentration of protein, 110
sweet acidophilus milk
history, 403
microbiology, 405
production, 404
quality, 405
sweeteners, 73–75, 224
  high intensity, 229
    acesulfame-K, 231
    alitame, 232
    aspartame, 230
    cyclamates, 232
    neotame, 231
    saccharin, 232
    stevia, 231–232
    sucralose, 230–231
    thaumatin, 232
  nutritive, 224–226
    corn sweeteners, 227, 228
    liquid sugar, 226
    maltodextrins, 227–229
    sucrose, 224

tanker, 54
temperature, 53, 54, 56, 57, 62, 63
testing body, 383
texture attributes, 362
  nonoral viscosity, 362
  oral viscosity, 362
  thermal processing, 107
  thermal properties, 44
  threshold, 357–358
  titratable acidity, 72, 74, 75, 77
tubular, 112
turbulence, 84

UF. See ultrafiltration (UF)
ultrafiltered milk, 223–224
ultrafiltration (UF), 302, 304, 305, 311–313, 314
Universal Product Code, 89

Vaginitis, 427
vili, 9, 15, 119, 395, 437
  history, 408
  microbiology, 408
violet red bile agar, 341
viscometer, 345
vitamins, 422
volumetric flow, 6
volumetric flow meter, 97

water, 28
whey, 63
  solids, 221–223
whey products, 185
  microparticulated whey protein, 186
  whey powders, 185
  whey protein concentrates, 185–186
  whey proteins, 32–34, 417
  denaturation, heat, 274
  immunoglobulins, 33, 34, 417
α-lactalbumin, 33, 417
β-lactoglobulin, 33, 417
proteose peptones, 32

yakult, 437
ymer, 9, 15, 437
yogurt, 116, 359, 361, 363, 434
  acidification, 177
  bulk starter, 400
  effect of processing on starter, 117
  formulation, 280
  manufacture, 193, 263–295
    blended/swiss-style, 279
    concentrated, Greek, 291
    custard, 282
    drink/smoothies, 287, 288
    French style, 282
    frozen, 292
    fruit-flavored, 279
    heat-treated, 294, 295
    light, 281
    natural, 286
    nutritional profile, 417
    organic, 286, 287
    plain, 278
  plant cleaning and sanitizing, 319–330
  sundae style/fruit on the bottom, 283, 284, 285
  vanilla, 285
  whips/mousse, 289
yogurt: fruit preparations and flavoring materials, 195–215. See also fruit preparations
yogurt, manufacture of various types, 263–295
  blended, 280
    flow sheet diagram, 281
    classification, 269
    coagulation, 276
    concentrated/strained yogurt, 291
    cooling, 277–278
    custard style, 282
    flow sheet diagram, 293
    French style, 282
    frozen, 292–294
    fruit flavored, 279–285
    fruit on the bottom style, 283
  general procedure for all yogurt types, 263
  Greek style, 291
  light, 281
  market, 269–272
  organic, 286–287
  plain, 278–279
    flow sheet diagram, 281
Index 477

post culturing heat treatment, 294–295
processes, 272
pumping, 278
smoothies, drinks, 287–289
flow sheet diagram, 290
starter production, 265, 268
stirring, 278
styles and definitions, 268, 269
sundae style, 283
vanilla flavored, 285–286
whips, mousse, 289
yogurt market, 12, 13
sales trends, 13
segmentation, 12
yogurt microstructure, 187
fat globules, 182
yogurt packaging, 168–174, 264
yogurt: plant cleaning and sanitizing, 319–330
bacteriophage control, 328–329
CIP cleaning, 325–326
cleaning, 320
COP cleaning, 324–325
foam cleaning, 323–324
manual cleaning, 322–323
normal soils, 320
complex carbohydrates, 321
fat, 320
minerals, 321
proteins, 321
sugars, 320–321
phage control, 328–329
sanitizing, 326–328
special soils, 322
bacteriophage, 322
biofilms, 322
yogurt processing, principles of, 239–260
changes during processing, 256
carbohydrates, 256–257
cell mass, 258–259
flavor compounds, 257–258
lipids, 257
post-fermentation, 259–260
proteins, 257
vitamins, 259
coagulation, 276
cooling, 277–278
heat treatment, 239, 272
homogenization, 241, 275
mix preparation, 239
processing steps, 240, 272
starters for yogurt, 242–244
characteristics, 245
collaborative growth, 247
factors for growth, 244
inhibiting factors, 251
strain selection, 253
yogurt properties, effect of milk
breed and genetic variants, 180–181
mammalian species, 178
milk powders, 183
seasonal variations in milk, 181
yogurt: sensory analysis, 353
packaging, 264–265
statistics, 269, 271
styles and definition, 268, 269, 270
types of, 16, 117
yogurt starters, production, 265
yogurt texture, 177
homogenization, 182

Zabady, 7, 438