Subject Index

N-Acetylcysteine (NAC),
  supplementation 142, 143
ABP, see Athlete Biological Passport
ACTH, see Adrenocorticotropic hormone
Activin, inhibitors 122, 123
Adrenocorticotropic hormone (ACTH),
  exercise effects
    aging studies 78
    endurance exercise 13, 14
    measurement 13
    resistance exercise 15
    strong physical and physiologic stimuli
      response in trained subjects 18–22
Aging
  exercise response
    growth hormone/insulin-like growth
      factor axis 70–73
    hypothalamic-pituitary-adrenal
      axis 77–79
    sex steroids
      men 73–75
      women 76, 77
    muscle effects 68, 69
Akt, metabolic effect of exercise in strength
  training 49, 50
AMPK
  exercise response in muscle 53
  metabolic effect of exercise in endurance
    training 48, 50
Androgen abuse
  adverse effects 94, 95
  detection 84, 91–94
  doping types 88–90
  efficacy 85
  historical perspective 85, 86
  patterns and motivation 90, 91
  prevalence 87, 88
steroid profile 157, 158
steroidomics 158–163
therapeutic use exception 86, 87
Athlete Biological Passport (ABP) 125, 126,
  155, 158
BMD, see Bone mineral density
Bone
  exercise response in children 63, 64
  growth hormone/insulin-like growth factor
    effects 108, 109
Bone mineral density (BMD)
  female athlete triad 33–35
  testosterone correlations in male
    athletes 31
Caffeine, supplements 135, 137–139
Carnitine palmitoyltransferase 1 (CPT1),
  fatty acid metabolism during exercise 51, 52
Coenzyme Q10, supplementation 143
Corticotropin-releasing hormone (CRH),
  exercise effects
    endurance exercise 13, 14
    measurement 13
    resistance exercise 15
Cortisol, see Hypothalamic-pituitary-adrenal
  axis
CPT1, see Carnitine palmitoyltransferase 1
Creatine
  supplementation 134, 136, 137
CRH, see Corticotropin-releasing hormone
Dehydroepiandrosterone (DHEA), female
  athlete levels 36
DHEA, SEE Dehydroepiandrosterone
DHT, see Dihydrotestosterone
Diabetes type 2
chronic effect of exercise 55
insulin resistance 54
metabolic insensitivity and exercise 56
Dihydrotestosterone (DHT), exercise response in aging males 74, 75
Doping, see specific substances

EPO, see Erythropoietin
Ergogenic aids, see Supplements
Erythropoietin (EPO)
exercise response 120
expression and regulation 118–120
functional overview 115, 116
iron metabolism interactions 118
receptor 117
red blood cell response 15
stimulating agents
activin inhibitors 122, 123
GATA antagonists 123
gene transfer 124, 125
hypoxia-inducible factor antagonists 123, 124
mimetic peptides 122
overview 120, 121
recombinant agents 121, 122
structure 116, 117
Estradiol
exercise response
aging females 77
children 60, 61
female athlete triad 34
training effects in females 32
Fat metabolism
exercise response 51, 52
growth hormone/insulin-like growth factor effects 107
Female athlete triad 32–35
Ferritin 118
Follicle-stimulating hormone (FSH)
female athlete triad 33, 34
functional hypothalamic amenorrhea from exercise 36
functional overview 28
FSH, see Follicle-stimulating hormone
GATA, antagonists 123
GH, see Growth hormone
Glucocorticoids, see Hypothalamic-pituitary-adrenal axis
GLUT4, exercise response in muscle 52, 53
Glutamine, supplementation 145
Glutathione, supplementation 142, 143
Glycolysis, ATP production 45, 46
GnRH, see Gonadotropin-releasing hormone
Gonadotropin-releasing hormone (GnRH), functional overview 28
Growth hormone (GH)
adverse effects of administration 112
body composition response 109, 110
bone effects 108, 109
cortisol response 108
doping 101–105, 153–157
exercise effects
aging studies 70–72
children 59, 60
circulating levels 2, 3
exercise performance effects 110, 111
exercise stimulation 110
metabolism effects
carbohydrate 107, 108
lipid 107
protein 108
physiological effects 102, 107
regulation of release 2, 8, 105, 106
hCG, see Human chorionic gonadotropin
Hepcidin 118
Hexokinase II (HKII), exercise response in muscle 53
HIF-1, see Hypoxia-inducible factor-1
HKII, see Hexokinase II
HMB, see β-Hydroxy-β-methylbutyrate
HPA axis, see Hypothalamic-pituitary-adrenal axis
HPG axis, see Hypothalamic-pituitary-gonadal axis
Human chorionic gonadotropin (hCG), indirect androgen doping 88–90, 93
β-Hydroxy-β-methylbutyrate (HMB), supplementation 139, 140
Hypothalamic-pituitary-adrenal (HPA) axis adaptation to exercise training
children 62, 63
cortisol secretion in endurance-trained subjects 16–18
mild stress response 18
normal function in trained subjects 15, 16
oral contraceptive effects 23, 24
sex differences 22, 23
strong physical and physiologic stimuli response 18–22
exercise effects
  aging studies 77–79
  endurance exercise 13, 14
  measurement 13
  resistance exercise 15
growth hormone/insulin-like growth factor effects on cortisol 108
Hypothalamic-pituitary-gonadal (HPG) axis exercise response in children 60, 61
  females
    aging studies 76, 77
    androgens 36, 37
    functional hypothalamic amenorrhea from exercise 36
    menstrual cycle and oral contraceptive effects on exercise and training 37, 38
    training effects on testosterone and estradiol 32
  males
    aging studies 73–75
    fertility studies 31, 32
    leanness and relative energy deficiency in sport 30, 31
    testosterone response to exercise and training 28, 29
    regulation 28
Hypoxia-inducible factor-1 (HIF-1) antagonists 123, 124
metabolic effect of exercise in endurance training 48
IGF, see Insulin-like growth factor
Insulin-like growth factor (IGF)
  binding proteins 3, 4, 31
  bone effects 108, 109
  cortisol response 108
  functional overview 3, 4, 59
IGF-1
  adverse effects of administration 112
  aging studies 70–73
  body composition response 109, 110
  doping 103–105
  exercise performance effects 110, 111
  exercise response
    children 59, 60
    stimulation 110
  female athlete triad 33
  isoforms 72
metabolic effect of exercise in strength training 49
physiological effects 10
metabolism effects
  carbohydrate 107, 108
  lipid 107
  protein 108
  receptors and signaling 3, 4
  regulation 59, 106, 107
iron, homeostasis and metabolism 118
Isoflavones, supplementation 145
Krebs cycle, ATP production 46, 47
LCFAs, see Long-chain fatty acids
LH, see Luteinizing hormone
Lipoic acid, supplementation 143, 144
Long-chain fatty acids (LCFAs), metabolism during exercise 51, 52
Luteinizing hormone (LH)
  exercise response in aging males 74
  female athlete triad 33, 35
  functional hypothalamic amenorrhea from exercise 36, 61
  functional overview 28
  indirect androgen doping 88–90, 93
Mammalian target of rapamycin (mTOR), metabolic effect of exercise in strength training 49
Mass spectrometry (MS)
  androgen abuse detection 84, 91–93, 159–162
  growth hormone detection 155
Mechano growth factor (MGF), aging studies 72
Menstruation
  age at menarche and exercise 61
  exercise and training impact 37, 38
  functional hypothalamic amenorrhea from exercise 36
MGF, see Mechano growth factor
MicroRNA, doping biomarker applications 163–165
MS, see Mass spectrometry
mTOR, see Mammalian target of rapamycin
Muscle
  aging effects 68, 69
  exercise response
    combination training 50
    endurance training 47, 48
overview 47
strength training 49
glucose metabolism during exercise 52, 53
metabolic adaptation to training 53, 54
NAC, see N-Acetylcyesteine
OFF-hr score (OFFS) 126
OFFS, see OFF-hr score
Oral contraceptives
exercise and training impact 37, 38
female athlete triad 35
hypothalamic-pituitary-adrenal axis
exercise response impact 23, 24
Oxidative phosphorylation, ATP production 46, 47
Parathyroid hormone (PTH), exercise response in children 64
Phosphocreatine, ATP production 45
Polyphenols, supplementation 144, 145
Prolactin
exercise effects on circulating levels 7, 8
functional overview 7
regulation of release 7
Protein metabolism, growth hormone/insulin-like growth factor effects 108
PTH, see Parathyroid hormone
SARMs, see Selective androgen receptor modulators
Selective androgen receptor modulators (SARMs) 83, 84
Selective estrogen receptor modulators (SERMs) 84
SERMs, see Selective estrogen receptor modulators
Sex hormone-binding globulin (SHBG)
exercise response in aging males 74
female athlete levels 36
SHBG, see Sex hormone-binding globulin
SIRT1, metabolic effect of exercise in endurance training 48
Sotatercept 122
Supplements, see also specific supplements
efficacy evaluation and classification 130–133
European Food Safety Authority evaluation 132–134
functional classification 130
health risks 146
prevalence of use 128, 129
regulation 130
specificity of action 133
TBC1, exercise response in muscle 53
Testosterone, see also Androgen abuse
exercise response
aging males 73–75
children 60, 61
history of study 83
male response to exercise and training 28, 29
replacement therapy 83
therapeutic use exception 86, 87
training effects in females 32
Thyroid hormone
exercise effects
children 61, 62
circulating levels 5–7
functional overview 4, 5
regulation of release 5, 8
Thyroid-stimulating hormone (TSH), exercise effects
children 62
circulating levels 5–7
Transferrin (TfR) 118
Triad, see Female athlete triad
TSH, see Thyroid-stimulating hormone
Vitamin C, supplementation 134, 141, 146
Vitamin E, supplementation 141, 142, 146
WADA, see World Anti-Doping Agency
World Anti-Doping Agency (WADA) 86, 87, 101, 105, 125, 126, 155, 157, 158, 165