

Clinical Sports Nutrition

THIRD
EDITION

EDITED BY
LOUISE BURKE &
VICKI DEAKIN



*Keeping you
one step ahead*

Contents

Preface	xv
Acknowledgments	xvii
About the editors	xix
Editors and contributors	xxi

CHAPTER 1

Exercise physiology and metabolism 1

Mark Hargreaves

1.1	Introduction	1
1.2	Skeletal muscle	1
1.3	Exercise metabolism	3
1.4	Oxygen transport system	6
1.5	Temperature regulation and fluid balance	8
1.6	Fatigue	10
1.7	Summary	11

Practice tips 12

Nick Wray

References	17
------------	----

CHAPTER 2

Measuring nutritional status of athletes: clinical and research perspectives 21

Vicki Deakin

2.1	Introduction	21
2.2	Dietary measurement	22

2.3	Sources of error in dietary measurement	30
2.4	Criteria for interpreting dietary intakes	36
2.5	Clinical examination and medical history	41
2.6	Biochemical analysis	41
2.7	Anthropometric assessment	42
2.8	Summary	42
	Practice tips	44
	<i>Vicki Deakin</i>	
	References	47

CHAPTER 3

Kinanthropometry: physique assessment of the athlete 53

Deborah Kerr and Tim Ackland

3.1	Introduction	53
3.2	Physique assessment in athletes	54
3.3	Methodologies for assessing body composition	56
3.4	Indices of height and weight	60
3.5	Summary	64

Practice tips 66

Deborah Kerr and Tim Ackland

	References	69
--	------------	----

CHAPTER 4

Protein and amino acid needs for training and bulking up 73

Mark Tarnopolsky

4.1	Introduction	73
4.2	Protein metabolism	74
4.3	The effect of exercise on protein metabolism	79
4.4	Determining the adequacy of protein intake (dietary requirements) during exercise	87
4.5	Dietary protein requirements for athletes	89
4.6	Potential side-effects of excessive protein intake	97
4.7	Summary	98

Practice tips 99

Gary Slater

	References	103
--	------------	-----

CHAPTER 5

Energy requirements of the athlete: assessment and evidence of energy efficiency 113

Melinda M. Manore and Janice L. Thompson

5.1	Introduction	113
5.2	Energy and macronutrient balance	114
5.3	Macronutrient balance	115

5.4	Energy expenditure	117
5.5	Energy efficiency: does it exist?	127
5.6	Summary	129
	References	130

CHAPTER 6

Weight loss and the athlete **135**

Helen O'Connor and Ian Caterson

6.1	Introduction	135
6.2	Justification for weight loss in athletes	135
6.3	Factors influencing the ability to achieve optimal body weight and composition in athletes	137
6.4	Approaches to weight and fat loss in athletes	145
6.5	Negative aspects of weight control in athletes	153
6.6	Adjunctive agents for weight and fat loss	155
6.7	Guidelines for fat loss	158
6.8	Summary	159

Practice tips **161**

Helen O'Connor and Ian Caterson

	References	165
--	------------	-----

CHAPTER 7

Making weight in sports **175**

Janet Walberg Rankin

7.1	Introduction	175
7.2	Sports with weight divisions or restrictions	176
7.3	Methods used to make weight	176
7.4	Weight loss and competitive success	178
7.5	Potential negative consequences to weight loss	178
7.6	Strategies for weight loss	182
7.7	Recovery strategies	183
7.8	Measures to reduce dangerous weight loss practices	185
7.9	Summary	187

Practice tips **189**

Greg Cox

	References	196
--	------------	-----

CHAPTER 8

Disordered eating in athletes **201**

Katherine A. Beals and Linda Houtkooper

8.1	Introduction	201
8.2	Disordered eating categories/classifications	202

8.3	Prevalence of disordered eating among athletes	206
8.4	Aetiology of disordered eating among athletes	207
8.5	Performance and health consequences of disordered eating	211
8.6	Prevention of disordered eating among athletes	213
8.7	Management of disordered eating among athletes	215
8.8	Summary	219
	Practice tips	221
	<i>Belinda Dalton</i>	
	References	223

COMMENTARY A

	The evolution of the Female Athlete Triad	227
	<i>Anne Loucks</i>	

CHAPTER 9

	Bone, exercise and nutrition	237
--	-------------------------------------	------------

Deborah Kerr, Karim Khan and Kim Bennell

9.1	The fundamentals of bone physiology	237
9.2	Exercise effect on bone in athletes and healthy people	239
9.3	Calcium intake and bone mineral changes at various life stages	242
9.4	Effects of amenorrhoea on bone mass	246
9.5	Stress fractures in athletes with menstrual disturbances	249
9.6	Summary	251

	Practice tips	253
--	----------------------	------------

Deborah Kerr, Karim Khan and Kim Bennell

	References	254
--	------------	-----

CHAPTER 10

	Iron depletion in athletes	263
--	-----------------------------------	------------

Vicki Deakin

10.1	Introduction	263
10.2	Stages of iron depletion	263
10.3	How common is iron deficiency in athletes?	265
10.4	Why is iron important to athletes?	266
10.5	Effects of iron status on performance and other health outcomes	267
10.6	Dietary iron absorption	271
10.7	Causes of iron deficiency in athletes	275
10.8	Assessment of iron status of an athlete: clinical perspectives	279

10.9	Dietary intervention for iron depletion and iron deficiency	290
10.10	Medical intervention: iron supplements	291
	Practice tips	295
	<i>Vicki Deakin and Fiona Pelly</i>	
	References	303

CHAPTER 11

Vitamin, mineral and anti-oxidant needs of athletes **313**

Mikael Fogelholm

11.1	Vitamins and minerals, and sports—an introduction to the topic	313
11.2	Measuring vitamin and mineral status in athletes	315
11.3	Effects of exercise on vitamin and mineral requirements of athletes	319
11.4	Biochemical indicators of vitamin and mineral status in athletes	321
11.5	Does marginal deficiency of vitamins and minerals affect physical performance?	324
11.6	Effects of supplementation on biochemical indices of micronutrient status and physical performance	326
11.7	Potential risks of vitamin and mineral supplements	330
11.8	Summary	332

Practice tips **334**

Julie Tatnell and Trent Watson

	References	336
--	------------	-----

COMMENTARY B

The science of anti-oxidants and exercise performance **343**

Trent Watson

CHAPTER 12

Preparation for competition **355**

Louise Burke

12.1	Introduction	355
12.2	Nutritional factors causing fatigue during performance	355
12.3	Pre-event fuelling	357
12.4	The pre-event meal (1–4 hours pre-event)	363
12.5	Pre-exercise hydration	371
12.6	Summary	374

Practice tips **376**

Lorna Garden

	References	380
--	------------	-----

CHAPTER 13

Fluid and CHO intake during exercise 385

Ron Maughan

- 13.1 Introduction 385
- 13.2 Fatigue during exercise 386
- 13.3 CHO supplementation during exercise 386
- 13.4 Effects of hyperthermia and dehydration on performance 393
- 13.5 Guidelines for replacing fluid and CHO during exercise 397
- 13.6 Monitoring individual fluid needs 401
- 13.7 Summary 402

Practice tips 404

Michelle Minehan

- References 409

CHAPTER 14

Nutrition for recovery after training and competition 415

Louise Burke

- 14.1 Introduction 415
- 14.2 Issues in post-exercise refuelling 416
- 14.3 CHO intake guidelines for training and recovery 424
- 14.4 Issues in post-exercise rehydration 430
- 14.5 Alcohol and recovery 438
- 14.6 Summary 439

Practice tips 441

Louis Burke

- References 447

CHAPTER 15

Nutritional strategies to enhance fat oxidation during aerobic exercise 455

John Hawley and Louise Burke

- 15.1 Introduction 455
- 15.2 Triacylglycerol as an energy source during exercise 455
- 15.3 Intramuscular triacylglycerol and insulin resistance: the metabolic paradox 457
- 15.4 Processes that could limit fatty acid oxidation during exercise 457
- 15.5 Methods to quantify lipid metabolism during exercise 461
- 15.6 The effects of exercise intensity on lipid metabolism 462
- 15.7 Why can't fatty acid oxidation sustain intense exercise? 463
- 15.8 Nutritional strategies to enhance fat oxidation during exercise 465

- 15.9 Summary and recommendations for sports practitioners 477

- References 478

CHAPTER 16

Supplements and sports foods

485

*Louise Burke, Michelle Cort, Greg Cox, Ruth Crawford, Ben Desbrow,
Lesley Farthing, Michelle Minehan, Nikki Shaw, Olivia Warnes*

16.1	Introduction	485
16.2	Overview of supplements and sports foods	485
16.3	The pros and cons of using supplements and sports foods	488
16.4	Finding proof of the efficacy of supplements and sports foods	493
16.5	The AIS Sports Supplement Program	498
16.6	Summary	568
	References	568

COMMENTARY C

Nutrition for the athlete's immune system: eating to stay well during training and competition

581

David Pyne

CHAPTER 17

Nutrition for special populations: children and young athletes

589

Shona Bass and Karen Inge

17.1	Introduction	589
17.2	Skeletal growth and maturation in young elite athletes	589
17.3	Nutritional needs for young elite athletes	603
17.4	Hydration and thermoregulation	611
17.5	Food habits	615
17.6	Perception of body image	616
17.7	Sources of nutrition information for adolescents	617
17.8	Summary	618
	Practice tips	620
	<i>Kylie Andrew</i>	
	References	625

CHAPTER 18

Nutrition and the ageing athlete

633

Peter Reaburn

18.1	Introduction	633
18.2	Physiological changes in ageing athletes	635
18.3	Energy requirements of ageing athletes	636
18.4	Macronutrients	638
18.5	Micronutrients	643
18.6	Water	656
18.7	Nutrients, health and chronic disease	657

18.8	Medications: nutrient interactions	658
18.9	Supplementation	658
18.10	Summary	660
	Practice tips	662
	<i>Glenn Cardwell</i>	
	References	666

CHAPTER 19

Special needs: the athlete with diabetes **677**

Lyn Brown, Dennis Wilson, Gabrielle Cooper and Vicki Deakin

19.1	Introduction	677
19.2	Physiological effects of exercise	679
19.3	Nutritional management for athletes with type I diabetes	681
19.4	Insulin adjustments for athletes with type 1 diabetes	685
19.5	Monitoring blood glucose levels	688
19.6	Special problems for the athlete with type 1 diabetes	688
19.7	Physical activity for people with type 2 diabetes	691
19.8	High-risk sports	691
19.9	Insulin abuse and sport	692
19.10	Summary	692

Practice tips **693**

Elizabeth Broad

	References	695
--	------------	-----

CHAPTER 20

Special needs: the vegetarian athlete **699**

Greg Cox

20.1	Introduction	699
20.2	Types of vegetarian diets	700
20.3	Effect of vegetarian diets on health outcomes	701
20.4	Effect of vegetarian diets on exercise performance	701
20.5	Diet-related concerns for vegetarian athletes	704
20.6	Are creatine supplements of benefit to vegetarian athletes?	709
20.7	Vegetarian eating and menstrual dysfunction	710
20.8	Summary	711

Practice tips **713**

Greg Cox

	References	715
--	------------	-----

CHAPTER 21

Athletes with gastrointestinal disorders **721**

Kieran Fallon

21.1	Introduction	721
21.2	Upper-GI tract	721

21.3	Lower-GI tract	725
21.4	The effect of exercise on the gastrointestinal system: disorders specifically related to exercise	729
	Practice tips	733
	<i>Lisa Sutherland</i>	
	References	737
CHAPTER 22		
	Special needs: athletes with disabilities	739
	<i>Elizabeth Broad</i>	
22.1	Introduction	739
22.2	Classification of disabilities	740
22.3	Differences between athletes with disabilities and able-bodied athletes	742
22.4	Dietary issues for athletes with disabilities	747
	Practice tips	750
	<i>Elizabeth Broad</i>	
	References	751
CHAPTER 23		
	Medical and nutritional issues for the travelling athlete	755
	<i>Mark Young and Peter Fricker</i>	
23.1	Introduction	755
23.2	Jet lag and jet stress	755
23.3	Illnesses associated with travelling	757
	Practice tips	759
	<i>Lorna Garden</i>	
	References	763
CHAPTER 24		
	Nutritional issues for special environments: training and competing at altitude and in hot climates	765
	<i>Mark Febbraio and David Martin</i>	
24.1	Introduction	765
24.2	Nutritional requirements at high altitude	766
24.3	Exercise in a hot environment	769
24.4	Special strategies for exercise in the heat: glycerol hyperhydration	774
24.5	Summary	776
	Practice tips	777
	<i>Louise Burke</i>	
	References	780

CHAPTER 25

Providing meals for athletic groups **785**

Nicola Cummings, Ruth Crawford, Michelle Cort and Fiona Pelly

25.1 Introduction 785

25.2 Influencing the food selection of athletes 785

25.3 Strategies to modify food supply in a catering environment 789

25.4 A residential catering operation in practice—the AIS dining hall 795

25.5 Catering for large scale competition events—the Sydney 2000 Olympic Games 796

25.6 Summary 799

Practice tips **800**

Nicola Cummings

References 803

Index 807