Weight regulation and recovery for kickboxers WC 2015

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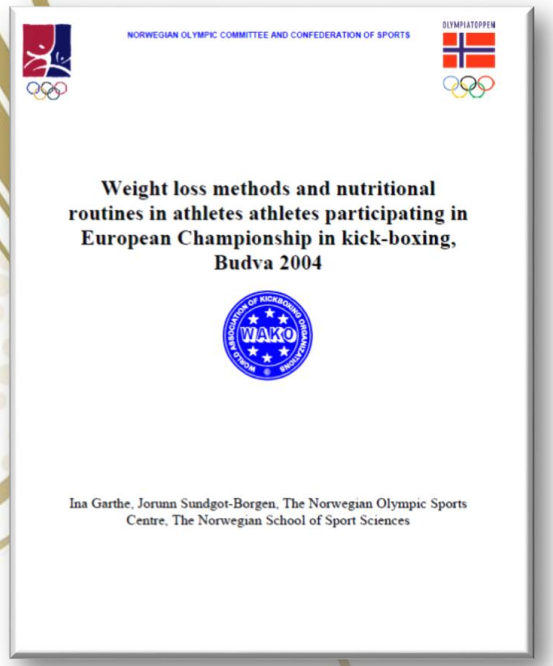




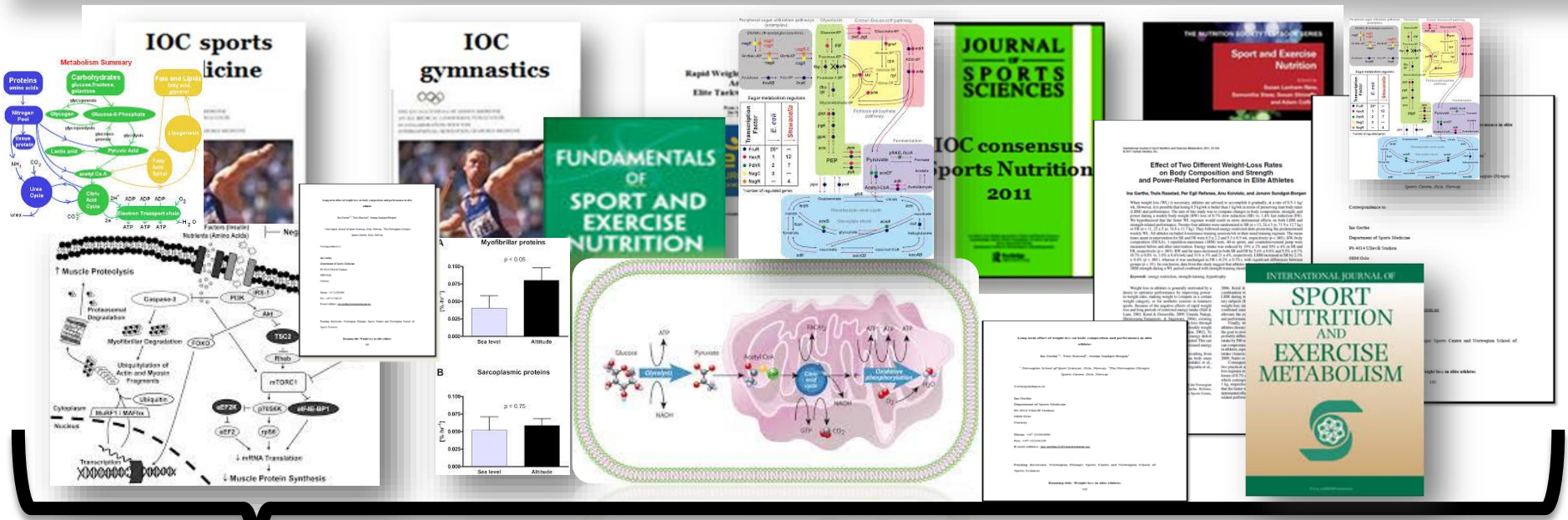


Intro

Weight-class athletes

- Weight loss in athletes, prevalence, methods and frequency
- Weight loss and its implications for health and performance
- How to use nutrition for optimal adaptation and recovery?
  - Protein metabolism & anabolic effect of training
- Practical suggestions

Twitter et al. is not science



Best practice

"The right foods makes me tougher both physically and mentally

Thea Therese Vingmark Næss

Gradual weight loss *	Rapid weight loss **
Modestly reduced EI	Active or passive dehydration
Modest increase EE	Very low EI or fasting
Change of E% in diet	Increased EE
Loss of 0.5- per week	Duration 12-96 hours
Duration ≥ 1 week	

** Based on loss of fat mass*

*** Based on body fluid loss*

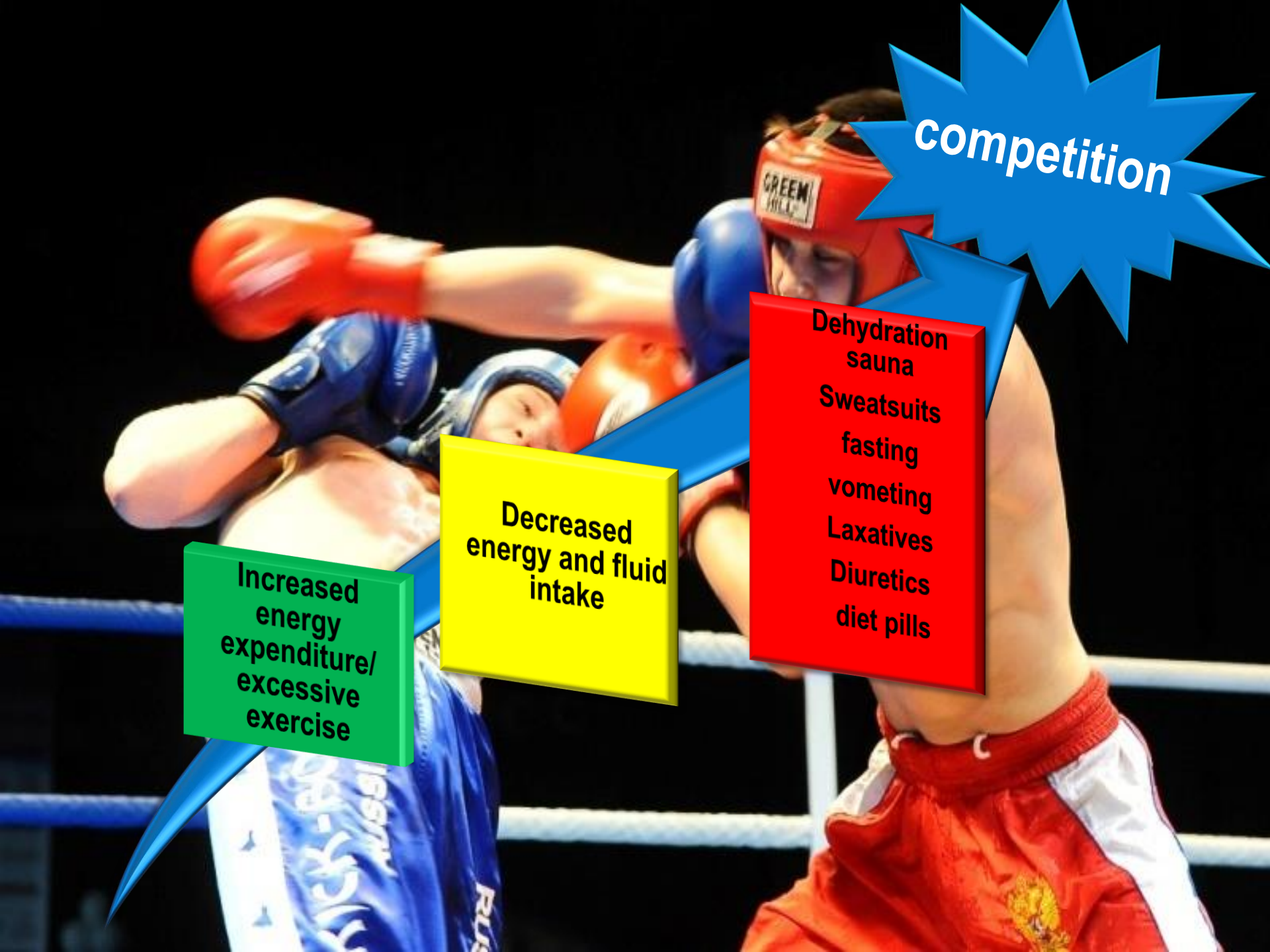
Modified from Fogelholm et al 1993

SPORT	DURATION AND FREQUENCY	WEIGHT CATEGORIES	WEIGH-IN PROCEDURE
Wrestling Senior International (Greco Roman and freestyle)	1 bout = 3x2 minute rounds. Each weight category is contested over one day. ≤ 4 bouts each day of competition. (competition lasts ≤ 4 hours).	♀ =7 ♀ =4*	One weigh-in (30 minute period) on the evening prior tournament
Weightlifting	Two lifts m… exec… a)…		…gh-in in the morning .Two hours …rt of the …asts one hour
Boxing **Amateu…**			…first competition …those drawn to …rning. There …h-in and
Judo			…hour period). …tween weigh- …ion.
Taekwondo			…ng before …eigh-in at the start of
Lightweight rowing	Race is over 2000 … every second day o…	…weight of crew: ≤70 (57)kg. Individual weight >72.5 (59)kg NOT accepted. Maximum weight for a single sculler: >72.5 (59)kg.	…Weigh-in each day and for each event. Weigh-in not less than 1 hour and not more than 2 hours before start of race.

Kickboxing

- Daily weigh-ins
- Minimum 3 hours between weigh-in and competition
- Usual weight categories

* Olympics


competition
Dehydration
sauna
Sweatsuits
fasting
vometing
Laxatives
Diuretics
diet pills
Decreased energy and fluid intake
Increased energy expenditure/ excessive exercise

Status quo

- Up to 94% of the weight-class athletes lose weight prior competition
- - 2-13% (3-6%)
- Power to weight ratio
- ”Part of the game”/”everybody does it”
- Increased anger

Sundgot-Borgen & Garthe 2011; Artioli et al. 2010; Marquart & Sobal 1994; Hall & Lane 2001; Oppliger et al. 2003; Alderman et al. 2004

Age and methods

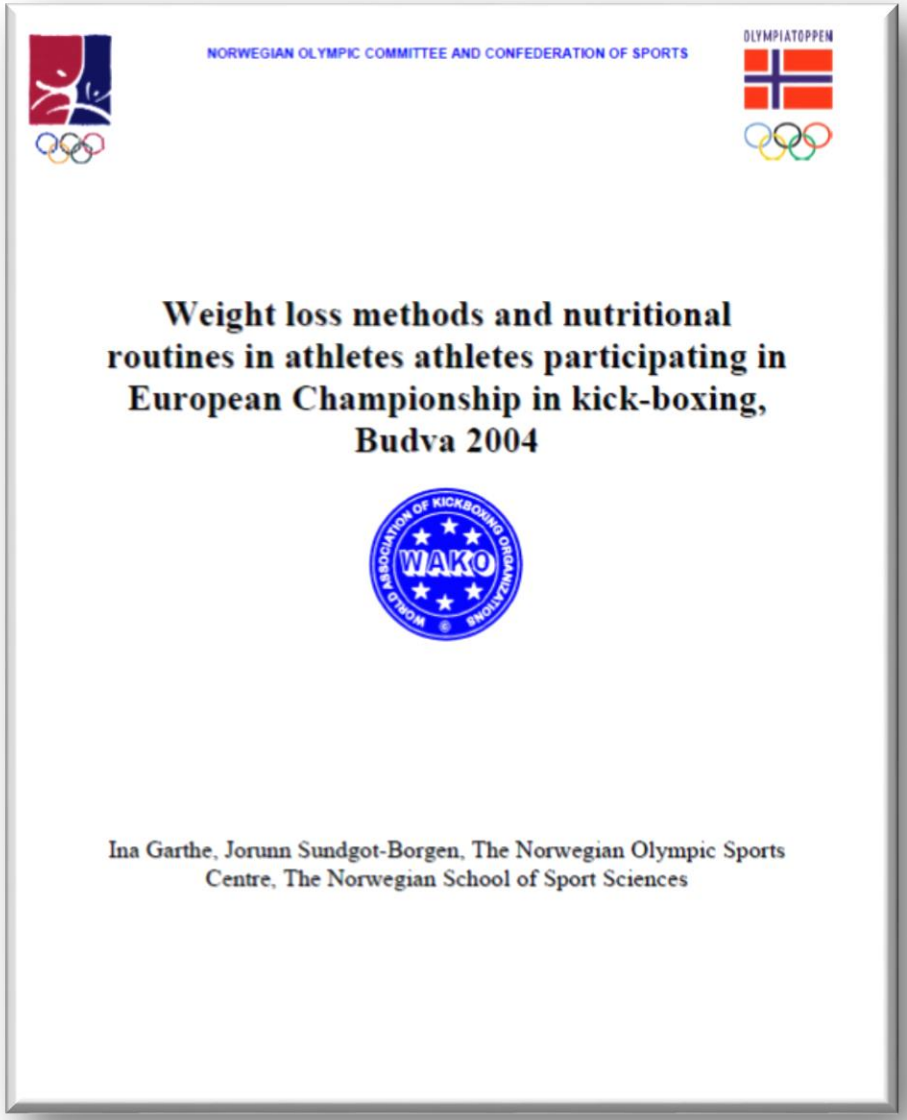
Study	Method, n and athletes that regularly lose weight	Age began Losing Weight (yr) (mean ± SD)	Weight lost (kg) (mean ± SD)	Sauna	Rubber suit	Fluid Restriction	Food restriction	Fasting	Laxatives	Diuretics	Spitting	Vomiting	Exercise	Gradual dieting
Steen & Brownell (1990)	Close ended questionnaire, male college wrestlers, n=63 (89%)	14.0±2.0	4.4±2.1 * 7.2±3.2* *	78	90	95	93	73	7	3	----- -	2	----- -	----- -
Oppliger et al. (2003)	Close ended questionnaire, male college wrestlers, n= 41 (84%)	13.7±3.4	--------- 5.3±2.8* *	32	6	21	46	8	3 #	3* #	9	2 #	75	80
Alderman et al. (2004)	Structured interview, male NWC wrestlers, n=45	----------	--------- 5.3 * *	56	49	-------	------	----- -	11	11	----- -	0	91	----- -
Slater at al. (2005a)	Close ended questionnaire, male ight-weight rowers, n=58 (92%), female light-weight rowers, n=42 (94%)	----------	---------- ♂ 6.0 ** ♀ 4.5 **	♂ 33 ♀ 58	♂ 41 ♀29	♂ 21 ♀88	♂ 78 ♀ 94	♂ 7 ♀ 12	♂ 11 ♀ 68	-------	------	♂ 0 ♀0	♂ 33 ♀ 53	♂ 59 ♀ 94
Artioli et al. (2010a)	Close ended questionnaire, male judo athletes, n=607 females judo athletes, n=607 (89%) §	12.6±6.1	.6±1.6 * 4.0±3.1* *	a) 29 b) 55	a) 30 b) 40	a) 29% b) 55%	a) 19 b) 41	a) 12 b) 24	a) 3 b) 8	a) 2 b) 6	a) 19 b) 28	a) 0 b) 2	a) 62 b) 25	a) 18 b) 35

** = Usually weight loss ** = Most weight lost # = One time per month or more NWC = National wrestling Championship*
§ = Male and female data are merged due to no significant differences between gender a= always b= sometimes

The adolecent athlete

Long term goal:
focus on improvement of other performance variables

When do we start to manipulate weight for performance enhancement?



- Weight loss methods and nutritional routines in international level athletes in weight-category sports

- European Championship Budva 2004; 272 were asked to fill in the questionnaire. The response rate was 86% (n=234).

Weight reduction prior to competition

76% of the male athletes and 60% of the female athletes reduce their bodyweight before competition. The mean weight reduction was 4,1±2,1 kg (men) and 3,4±2,0 kg (women) (figure 2).

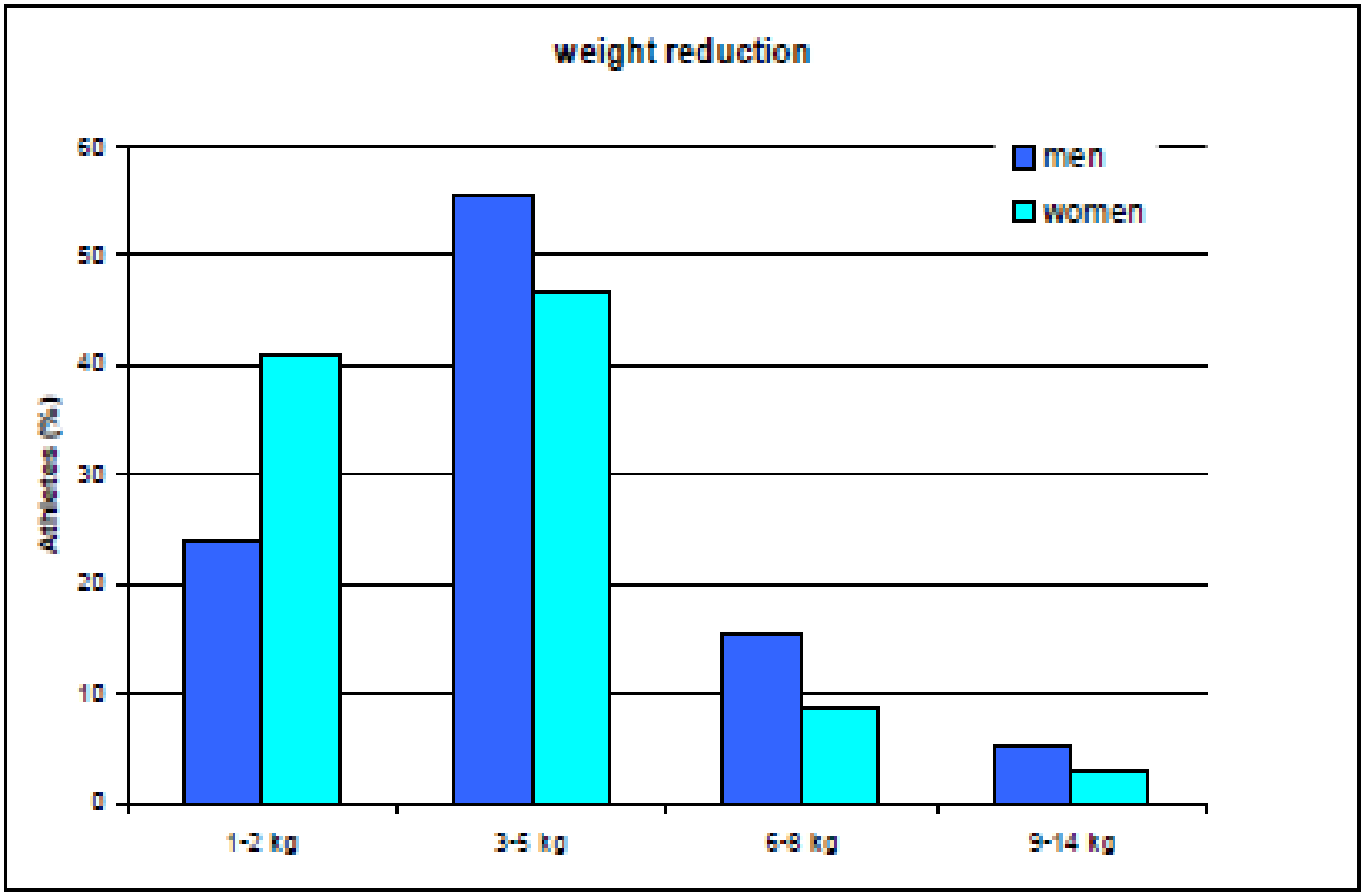


Figure 2. Bodyweight loss in kg

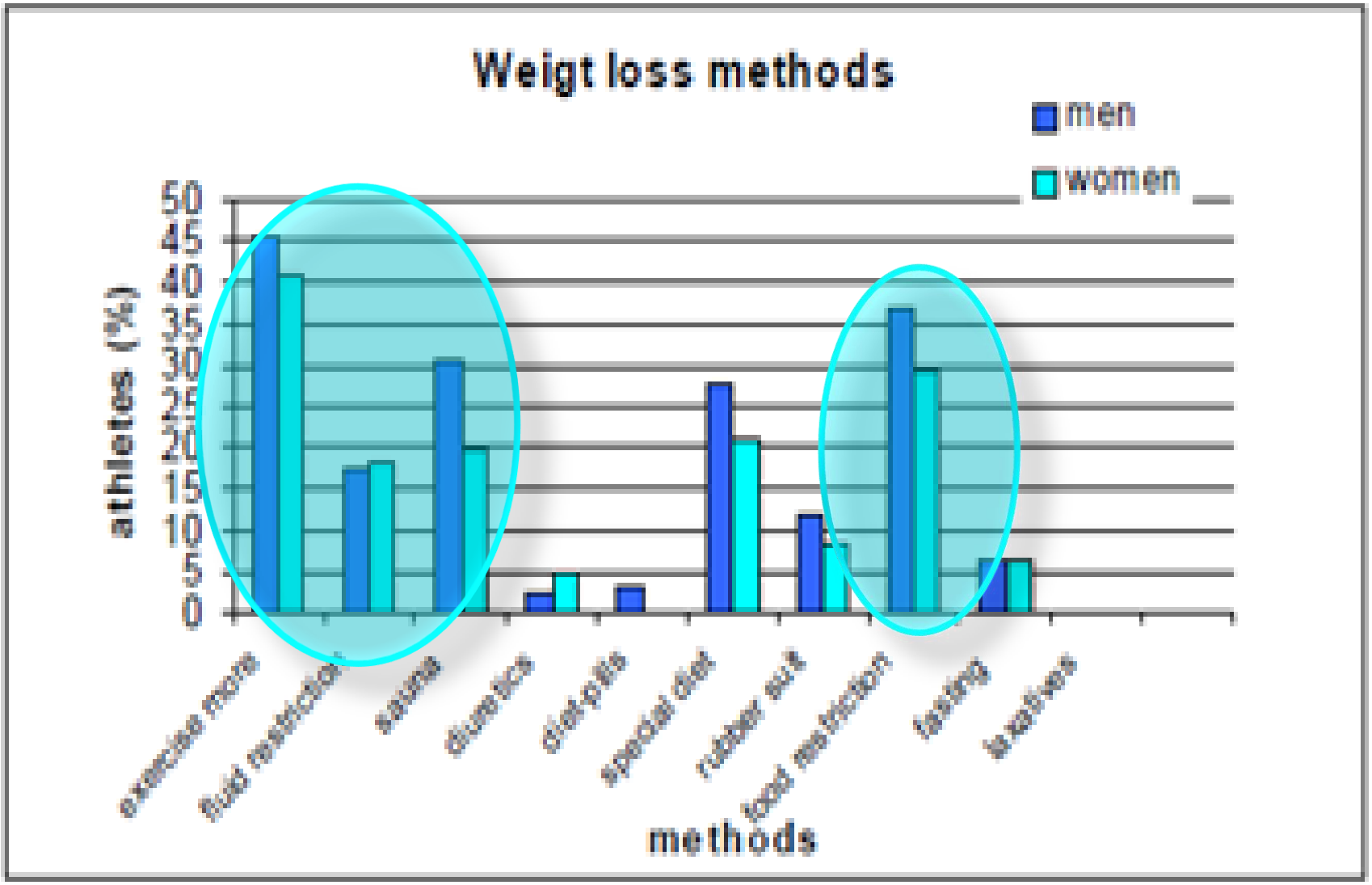


Figure 3. Reported weight loss methods

The first weight reduction

Fifteen percent of the athletes reported that they had their first weight reduction episode in the age between 10 to 15 years (figure 1)

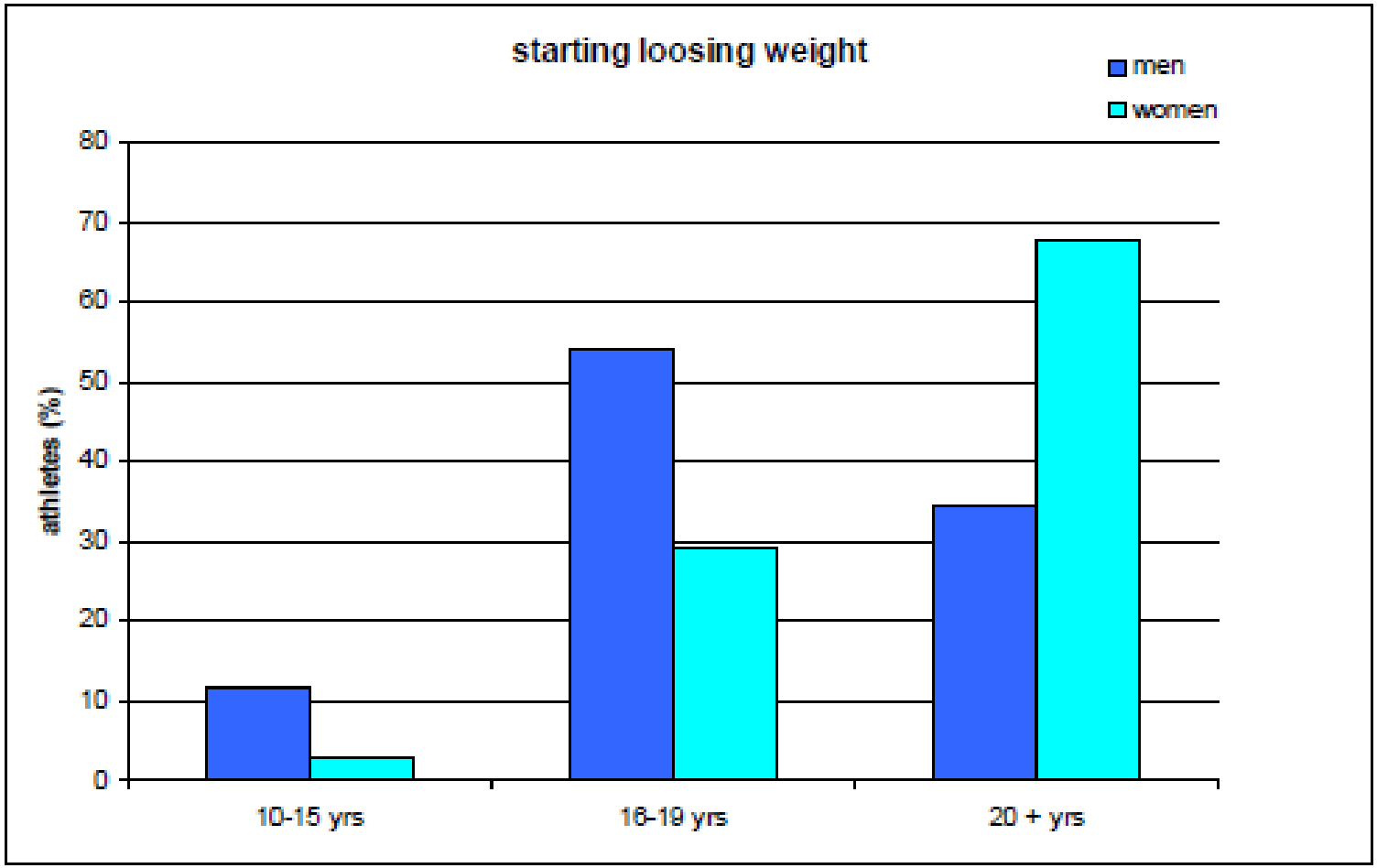


Figure 1. The athletes reported their age when they first reduced their weight prior competition

OLYMPIATOPPEN

Effect on performance

39% of the male athletes and 34% of the female athletes reported that weight loss impaired their performance (figure 4).

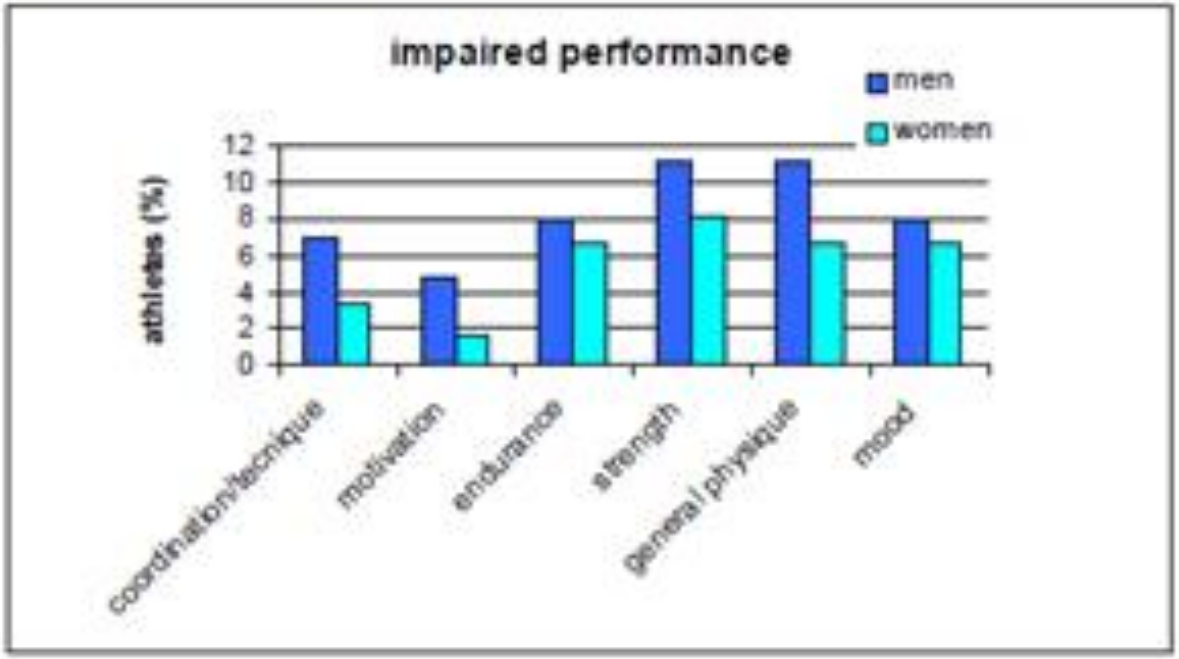


Figure 4. Self-reported impaired performance after weight loss. Presented in percent of the athletes who reported impaired performance.

Both male and female athletes reported that their weight reduction regime affected performance factors such as strength and endurance.

Guiding

58% of the males and 56% of the females reported that they did get help regarding weight loss (figure 5). As seen in figure 5, the coach was the most frequent person who guided the athletes in relation to the weight loss period

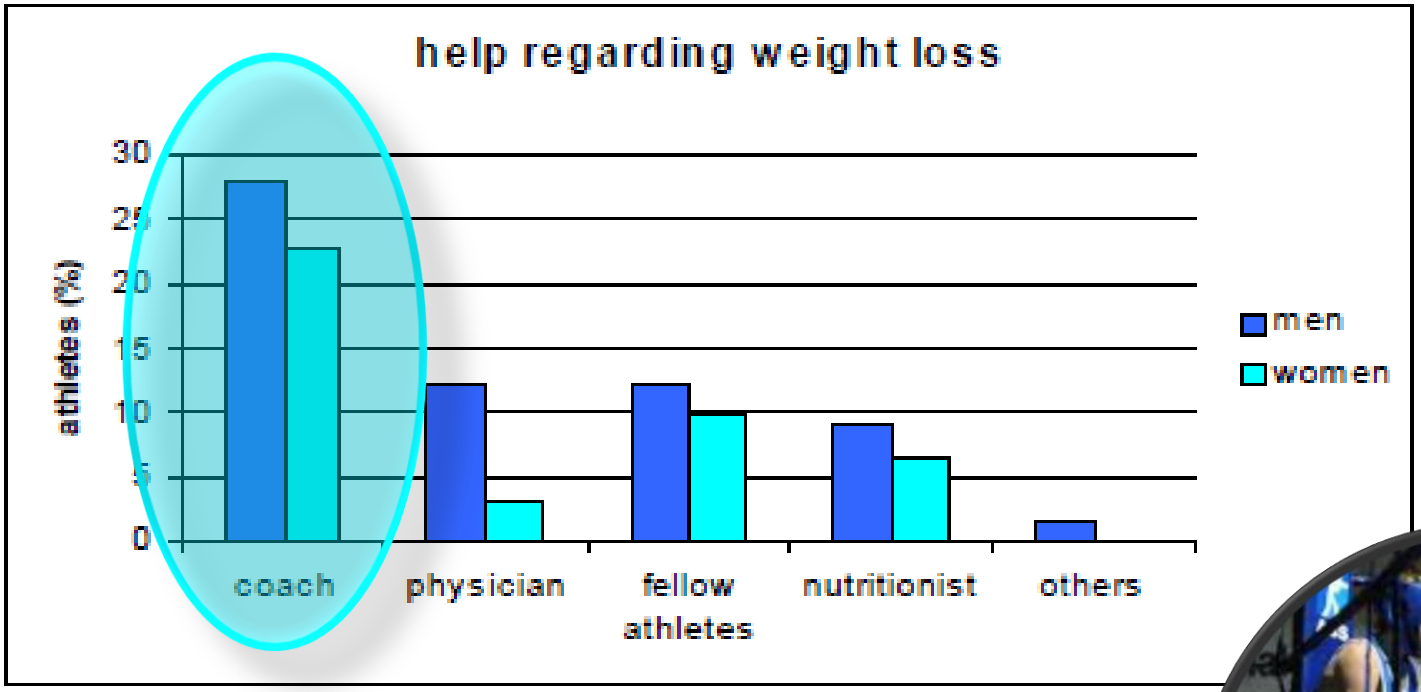
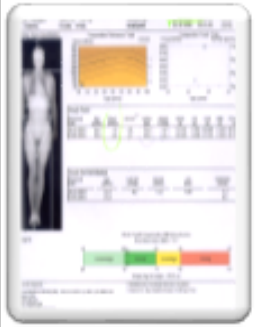


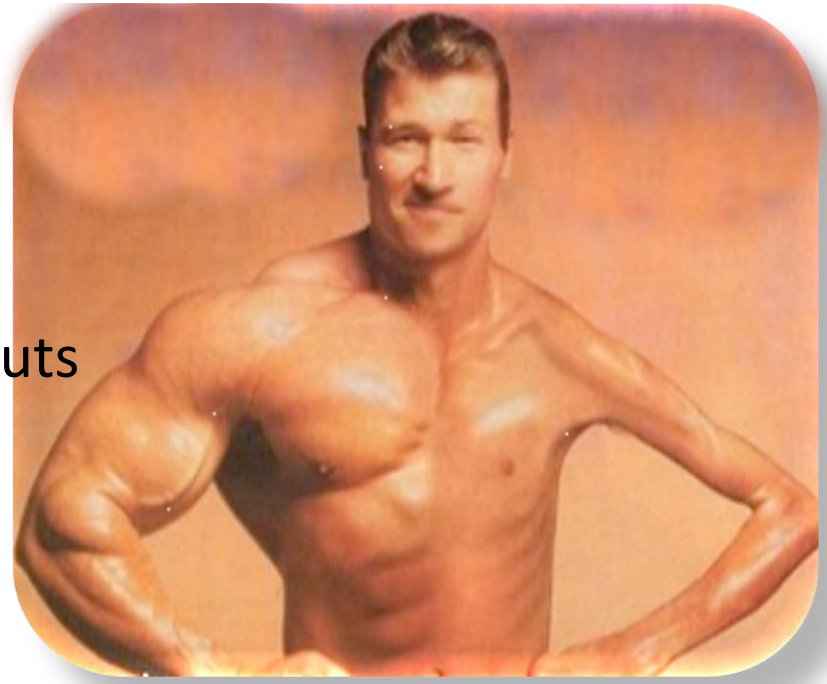
Figure 5. Person's that athletes reported guided them in relation to the weight loss period.

	Gradual weight loss 0.5-1.0 kg/week	Rapid Weight Loss (Days)	Extreme Weight Loss (hours)
Weight loss strategy and methods	 ➢ Moderate energy restriction ➢ Low-fat diet ➢ High-protein diet (2g/kg) ➢ ↑ Energy expenditure 	➢ Very-low energy diet ➢ Low CHO ➢ Some fluid restriction ➢ ↑↑ Energy expenditure ➢ ↑ endurance ➢ ↓ strength/power 	➢ Fasting ➢ Fluid restriction/dehydration ➢ Exercise in suits ➢ Sauna/hot tubs ➢ Laxatives/diuretics ➢ Purging/vomiting ➢ Spitting 
Current body weight → **Weight loss intervention** → **1-15 Times During Season Depending on Competition plan** → **Weigh-in**			
Changes in Body Composition 	➢ ***↓Body fat*** ➢ Maintain/increase/reduce lean body mass dependent on exercise stimuli and timing of meals	➢ ↓ Body fat ➢ ↓ Lean body mass ➢ ↓ Muscle glycogen storage ➢ ***↓ Body water***	➢ ↓ Muscle glycogen storage ➢ ***↓Body water and electrolytes***
Possible Health and Performance Consequences 	➢ Limited health concerns dependent on fat% ➢ Risk for disordered eating behavior, hormonal disturbance and ↓ BMD ➢ ↓ Immune function ➢ Risk for ↓ nutritional status over time ➢ ↓ metabolic rate	➢ ↓ Mood, cognitive function ➢ ↑ rate of perceived exertion ➢ Loss in strength, anaerobic and aerobic performance ➢ Moderate to severe dehydration ➢ Risk for heat stroke ➢ Risk for disordered eating behavior, hormonal disturbance and ↓ BMD ➢ ↓ Immune function ➢ Risk for ↓ nutritional status over time ➢ ↓ metabolic rate	➢ ↓ Mood, cognitive function ➢ ↑ rate of perceived exertion ➢ Loss in strength, anaerobic and aerobic performance ➢ Severe dehydration ➢ Risk for heat stroke ➢ Risk for disordered eating behavior, hormonal disturbance and ↓ BMD ➢ ↓ Immune function ➢ Risk for ↓ nutritional status over time ➢ ↓ metabolic rate

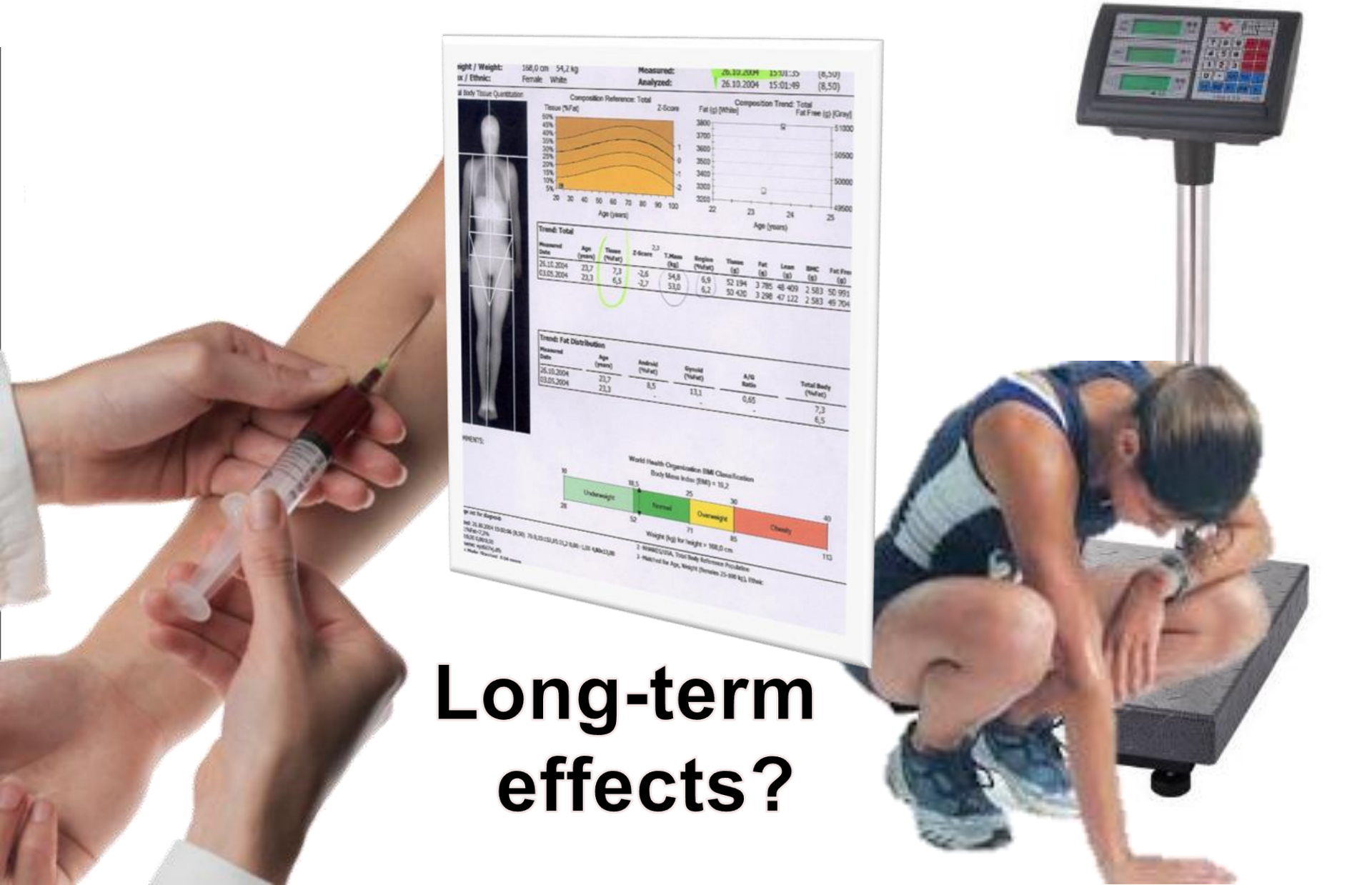
Challenges……

- Normal-weight athletes have less fat mass
- Large energy demands due to high training load
    - 1-3 sessions per day, over 20 hours/week
- Adapted metabolism
- Performance expectations
- Lack of time due to travelling,

competitions, frequent training bouts



Can weight loss impair health?



HORMONES
- Increased cortisol
- Increased grehlin
- Decreased thyroid hormones
- Decreased sirculating leptin
- Reduced oestrogen and testosterone consentrations (dependent on WL rate)

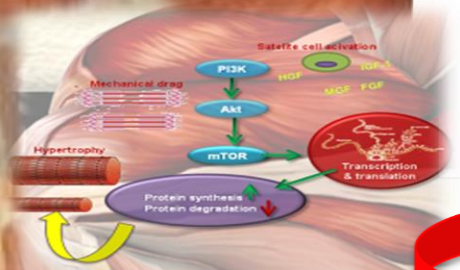
MITOCONDRIAL EFFICIENCY
- Reduced proton leak across mitocondrial membrane = reduced energy expenditure
- Reduced mitochondrial oxidative capacity

IMMUNE SYSTEM
- Increased oxidative stress
- Reduced antioxidant capacity

METABOLIC ADAPTATIONS
- Decreased energy expenditure (lower body weight and lower spontaneous physical activity)
- Reduces thermic effect of food (smaller meals)
- Increased skeletal work efficiency

SUBSTRATE USE AND BODY COMPOSITION
- Increased protein oxidation
- Increased fat oxidation
- Reduced glycogen storage and water
- Loss of LBM and fat mass
- Rapid replenishment of fat mass

TRAINING ADAPTATION
- Increased need for timing of energy intake (especially protein) to recover
- Decreased signalling response
- Increased amount of protein to get response



PROTEIN METABOLISM
- Increased protein oxidation
- Increased protein breakdown
- Decreased protein synthesis

Rapid weight loss - dehydration

Reduced coordination

Loss of electrolytes

Nausia, dizziness, fatigue

Increaced cellullar stress

Sweat and urine retention (increased levels of anti-diuretic hormone)

Severe dehydration may lead to organ failure and death

Reduced blood volume

Intracellular water in the bloodstream to maintain blood pressure

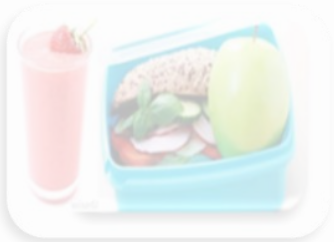
Increased hart frequency

Impaired body temperature regulation

Increased body temperature

Increased risk of edema

Shirreffs et al. 2004 Filaire et al. 2001; Smith et al.2001; Degoutte et al. 2006; Hillmann et al. 2011



NUTRIENTS
- Nutrient deficiencies
- Reduced glycogen storage

COGNITIVE PERFORMANCE
- Increased fatigue
- Impaired tactical ability
- Unfocused

MONES
- ed testosterone /
- n levels

- Increased hunger
- Decreased energy
- Loss of muscle mass
- Loss of fluid and electrolytes
- Reduced immun function
- Reduced thermoregulation

Lean body mass
- Increased protein breakdown
- Loss of lean mass
- Impaired strength and power

IMMUNE SYSTEM
- Reduced immune function
- Increased risk of injury
- Increased risk of illness
- Increased risk of chronical fatigue/ over training syndrome

nes
- Reduced growth
- Reduced bone mineral density
- Increased risk for fractures
- Increased risk of injury

Can athletes lose weight without compromising performance?

Performance – rapid weight loss

Study reference	Methods (% loss of body weight)	Recovery strategy	Performance testing/ Physical indicators of performance	Effect on performance	Comments
Finn et al. 2004 (15 wrestlers, males)	Weight loss (4.6%) by self selected energy- and fluid restriction over 3-5 days	2h recovery period with intake of equal volume of either 1.5g CHO/kg beverage or placebo (randomized).	Arm cranking ergometer. 8 bouts of 15s maximal effort intervals with 30s of easy pace between.	→	Both groups tended to lower negative affect score after recovery, suggesting a more euhydrated state.
Smith et al. 2000 (7 amateur boxers, males)	Dehydration (3.8%) by low-intense exercise for ≈ 2h in hot environment	_____	Simulated boxing-related task with3x3 min. rounds with 1 min. rest between on a boxing ergometer	↓	One athlete improved performance whereas mean reduction in performance were 27% for the other athletes
Smith et al. 2001 (8 amateur boxers, males)	Repeated (2 days between) weight loss (3%) by energy (1000 kcal/day)- and fluid restriction (1.0 ml/day).	_____	Repeated (2 days between) simulated boxing-related task with 3x3 min. rounds with 1 min. rest between on a boxing ergometer	→	Performance tended to be lower in both bouts but did not reach statistical significance due to large individual differences
Webster et al. 1990 (7 intercollegiate wrestlers, males)	Dehydration (4.9%) using exercise in a rubberized sweat suit over 36h.	_____	Strength (5 repetition of chest press, shoulder press, knee flexion and extension), anaerobic power, aerobic peak capacity and lactate threshold.	↓	Impairment in all test parameters. Although athletes had 36h to lose weight, all of the weight loss occurred within 12h before testing.

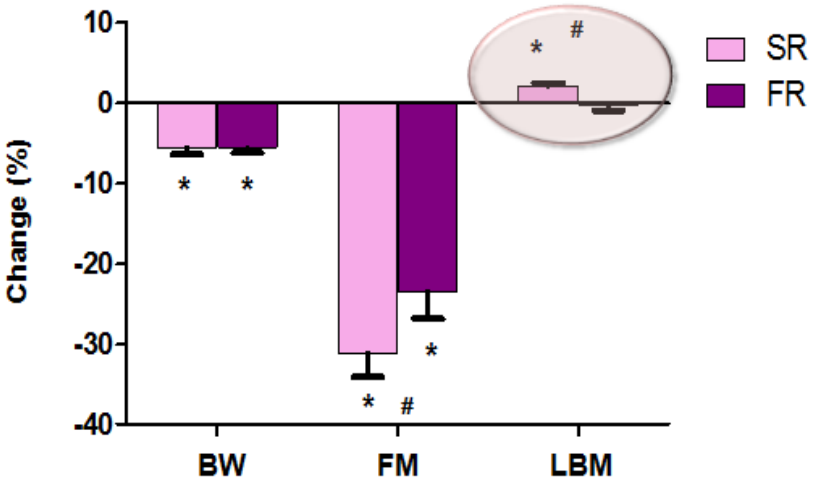
Slater et al. 2005 (17 competitive rowers, males and females)	Weight loss (4.3%) by energy- and fluid restriction over 24h	Aggressive nutritional recovery strategies in (2h) (2.3g/kg CHO, 34mg/kg Na, 28.4ml/kg fluid)	4 rowing ergometer time trials (2000m) separated by 48h in thermoneutral and hot environment	↓	Performance was impaired by 0.7% during thermoneutral trials and 1.1% during hot when trials were merged.
Slater et al. 2006 (17 competitive rowers, males and females)	Weight loss (3.9%) by energy- and fluid restriction and increased training load over 24h	Aggressive nutritional recovery strategies in (2h) (2.3g/kg CHO, 34mg/kg Na, 28.4ml/kg fluid)	3 on-water rowing time trials (1800m) separated by 48h	→	Environmental conditions were cool and there were slight variations in environmental conditions. There was a non-significant increase in time by 1.0 second.
Burge et al. 1993 (8 elite lightweight rowers, males and females)	Weight loss (5.2%) by energy- and fluid restriction combined with exercise over 24h	2h recovery period with an intake of water	Rowing ergometer time trial (2000m)	↓	Performance was impaired by 9%
Horswill et al.1990 (12 wrestlers, males)	2 x weight loss (6%) by energy- and fluid restriction over 4 days (one with low CHO intake and one with high CHO intake)	_____	Arm cranking ergometer. 8 bouts of 15s maximal effort intervals with 30s of easy pace between.	→ ↓	Performance maintained with the high CHO diet and impaired with the low CHO diet. Performance decreased more the 2nd time of weight loss.
Fogelholm et al.1993 (7 wrestlers and 3 judo athletes, males)	Weight loss (6%) by energy- and fluid restriction over 2.4 days	5h recovery period with ad libitum intake of food and fluid	Sprint (30-m run), anaerobic power (1-min Wingate test) and vertical jump height with extra load	→	Athletes regained 55% of body weight during recovery time

Degoutte et al. 2006 (10 judo athletes, males)	Weight loss (5%) by self selected energy- and fluid restriction over 7 days	_____	Handgrip strength, maximal strength, 30 s rowing task and simulated competition (5x5min bouts)	↓	Energy intake was reduced by 4 MJ per day during weight loss
Artioli et al. 2010 (14 judo athletes, males)	Weight loss (5%) by self selected energy- and fluid restriction over 7 days, n=7. (control group, n=7)	4h recovery period with ad libitum intake of food and fluid. Regained 51% of reduced weight.	Specific judo exercise, number of repeated attacks (10s, 20s, 30s, with 10s rest between), followed by 5min rest and a 5-min judo combat three bouts of upper-body Wingate test	→	Performance remained unchanged in specific judo exercise (number of attacks) Both control and intervention group had a slight improvement in Wingate test.
Filaire et al. 2000 (11 judo athletes, males)	Weight loss (4.9%) by self selected energy- and fluid restriction over 7 days (≈30% reduction in energy-, CHO- and fluid intake)	_____	Handgrip strength, 30s and 7s jump test	→ ↓	Performance remained unchanged for left arm strength and 7s jump test while were impaired for right arm strength and 30s jump test
Hall & Lane 2001 (16 amateur boxers, males)	Weight loss (5.2%) by energy- and fluid restriction over one week (self selected weight-loss strategy)	2 hours recovery with both food and fluid intake (self selected recovery strategy)	4x2 min. circuit training session with 1 min. recovery between rounds	→	Athletes failed to reach their subjective expected level of performance after weight loss.

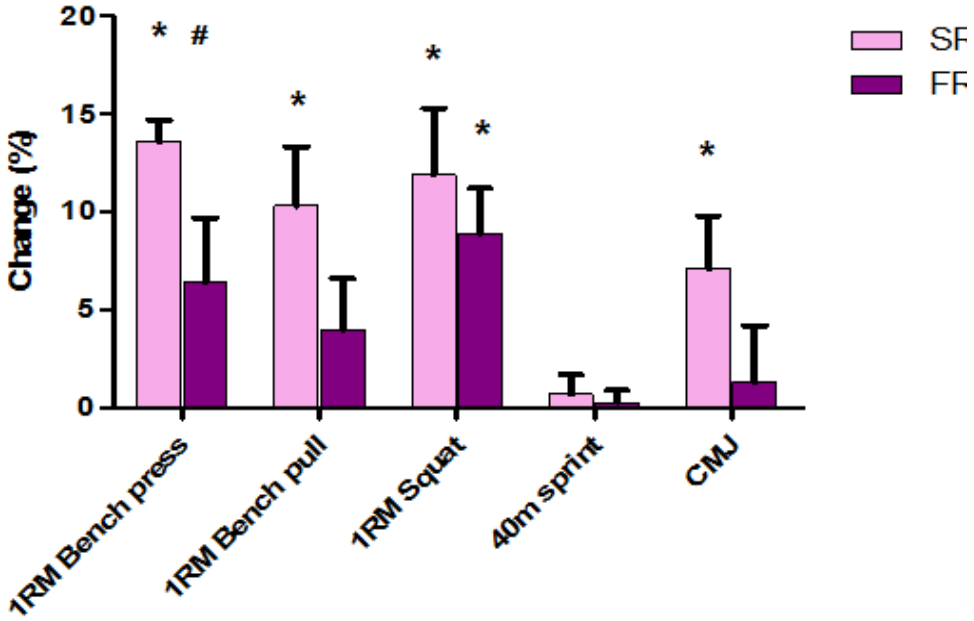
Performance – gradual weight loss

Fogelholm et al.1993 (7 wrestlers and 3 judo athletes, males)	Weight loss (5%) by energy restriction over 3 weeks	_____	Sprint (30-m run), anaerobic power (1-min Wingate test) and vertical jump height with extra load	→ ↑	Performance remained unchanged except for the vertical jump which improved by 6-8%
Koutedakis et al. 1994 (6 elite lightweigh t rowers, females)	Weight loss (6%) by energy restriction over 8 weeks	_____	VO2max, respiratory anaerobic threshold, upper body anaerobic peak power and mean power outputs, knee flexor and extensor and isokinetic peak torques	→ ↓	Performance remained unchanged except for a decrease in respiratory anaerobic threshold and knee flexor. 50% of weight lost as fat free mass
Koutedakis et al. 1994 (6 elite lightweigh t rowers, females)	Weight loss (7.4%) by energy restriction over 16 weeks	_____	Maximal rowing ergometer test and upper-body wingate test (VO2max, anaerobic threshold, peak power and mean power outputs) isokinetic knee flexor and extensor.	→ ↑	Improved performance in respiratory anaerobic threshold and knee flexor, VO2max and upper body anaerobic peak power 50% of weight lost as fat free mass

Body composition



Performance



Garthe et al. 2011 (11 elite athletes males, females	...mbined ...gth training ... 5 weeks	_____	Countermovement jump, 1RM squat, bench press, bench pull and 40m sprint	→ ↑	Performance remained unchanged except for an improvement in 1RM squat Energy intake was reduced by 30%.

Dairy products (milk, yoghurt, low fat cheese)

Fruits and vegetables

Whole grain foods

Lean meat

Fat fish

Optimal recovery meals

4-6 meals a day

07.00 Breakfast
2 dl oatmeal with skimmed milk (porridge)
10 g raisins
½ banana

Ca. 09.30 Snack
1 piece of hard whole wheat bred with egg + 1 fruit

Exercise (strength training)
Within 30 minutes: 1 Recovery bar or 2 dl fruit yoghurt (0,1% fat)

12.00 lunch
2 pieces of whole wheat bread with tuna + 2 dl orange juice

15.00 Dinner (split in two)
150-200 g chicken breast
300 g boiled vegetabeles
100 g brown rice
11 g olive oil
22 g Soy sauce/dressing

18.00 snack
1 piece of hard whole wheat bred with ham and cheese + 1 fruit

Exercise (sports specific training)
Within 30 minutes: 2 dl yoghurt with blueberry + 5 pieces of dried apricots

21.30 Evening meal
Dinner left-over
1 cup of cacao

		Week 1-3	Week 4-8	Week 9-12
Monday	Benchpress	1 x 12.10.8	1 x 12.10.8.6	1 x 10.8.6.6.6
	Bench pull	1 x 12.10.8	1 x 12.10.8.6	1 x 10.8.6.6.6
	Chins or pull down	3 x max	4 x max	5 x max
	Pec deck	3 x 12	4 x 10	5 x 8
	Pull-up	3 x 12	4 x 10	5 x 8
	Deltarase	3 x 12	4 x 10	5 x 8
	Back roll	3 x 15	3 x 12	3 x 10
Thuesday	Clean	2 x 5	3 x 4	4 x 4
	CMJ 0-40 kg	2 x 5	3 x 4	4 x 4
	Squat	1 x 12.10.8	1 x 12.10.8.6	1 x 10.8.6.6.6
	Deadlift	3 x 10	4 x 8	5 x 5
	Leg extension	3 x 12	4 x 10	5 x 8
	Leg curl	3 x 12	4 x 10	5 x 8
	Dips	3 x max	4 x max	5 x max
	Bicepscurl manual	3 x 12	4 x 10	5 x 8
	Abs crunch	3 x 15	3 x 12	3 x 10
	Rotary torso	3 x 12	3 x 10	3 x 8
Friday	Benchpress	1 x 12.10.8	1 x 12.10.8.6	1 x 10.8.6.6.6
	Rowing	1 x 12.10.8	1 x 12.10.8.6	1 x 10.8.6.6.6
	Pull down	3 x 12	4 x 10	5 x 8
	Flies	3 x 12	4 x 10	5 x 8
	Pull-up	3 x 12	4 x 10	5 x 8
	Shoulderpress	3 x 12	4 x 10	5 x 8
	Rygg-ups rull opp	3 x 15	3 x 12	3 x 10
Saturday	Clean	2 x 5	3 x 4	4 x 4
	Half squat	2 x 6	3 x 6	4 x 6
	Squat	1 x 12.10.8	1 x 12.10.8.6	1 x 10.8.6.6.6
	Deadlift	3 x 10	4 x 8	5 x 5
	Hack-lift	3 x 12	4 x 10	5 x 8
	Deadlift with straight legs	3 x 12	4 x 10	5 x 8
	Triceps pushdown	3 x 12	4 x 10	5 x 8
	Bicepscurl Z-stang	3 x 12	4 x 10	5 x 8
	Hangig situps	3 x max	3 x max	3 x max
	Standing torsy rotary	3 x 12	3 x 12	3 x 12

Summary Performance

- The effect of weight loss on performance depends on the athlete's initial percentage of body fat, the magnitude of the weight loss and the strategy used for weight loss and recovery

- Rapid weight loss
  - Magnitude of the weight loss, strategy used for recovery, time form weight-in to competition

- Gradual weight loss
  - Loss of lean mass depends on weight loss method and muscle stimuli
  - Mental challenging

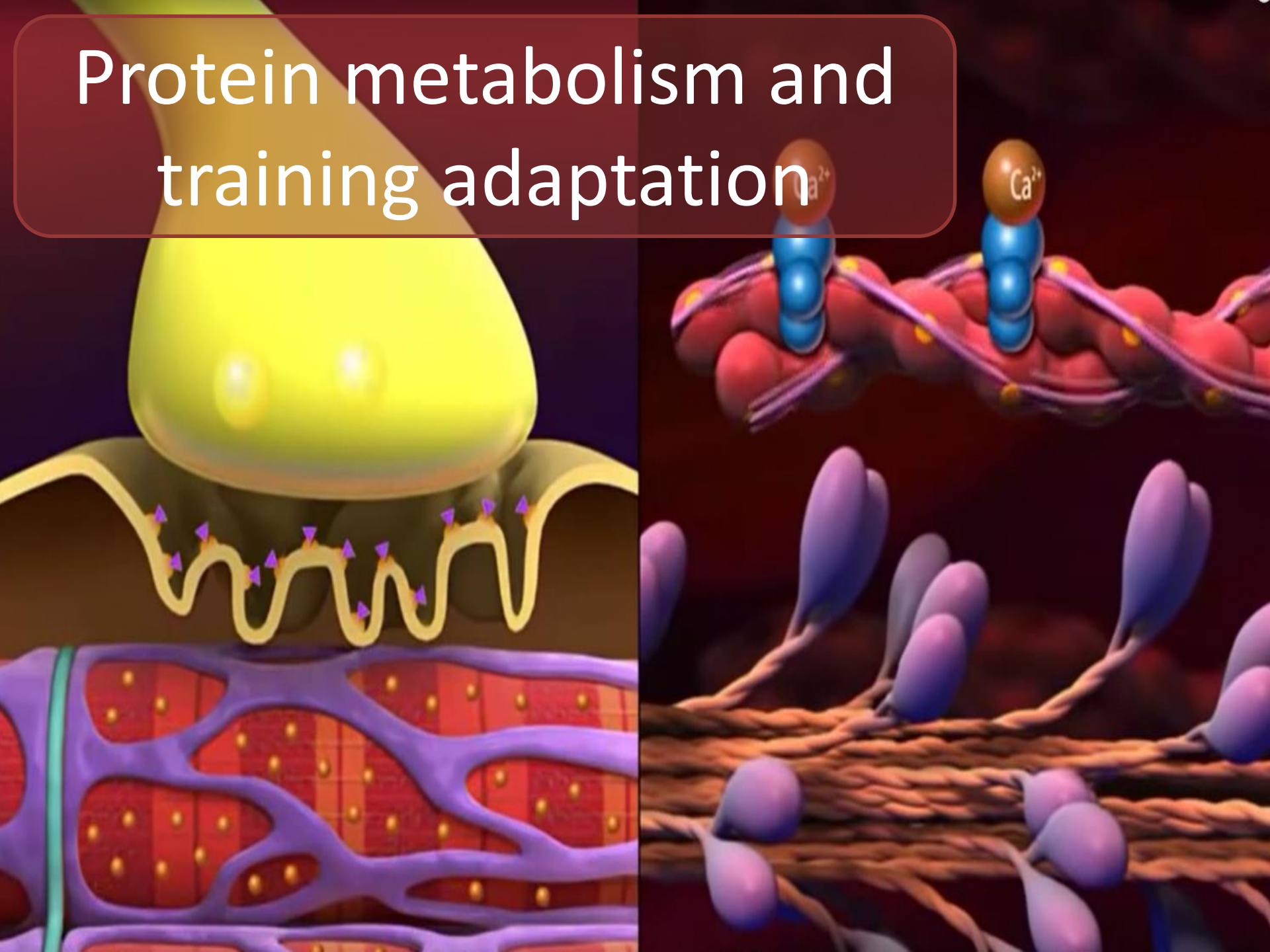
- Gradual weight loss seems to have less negative effect on performance than rapid weight loss > 3% (dependent on recovery time)

- Combined methods?
  - **Gradual 2 kg, 1 kg fast**
  - **Gradual 5 kg, 3 kg fast**

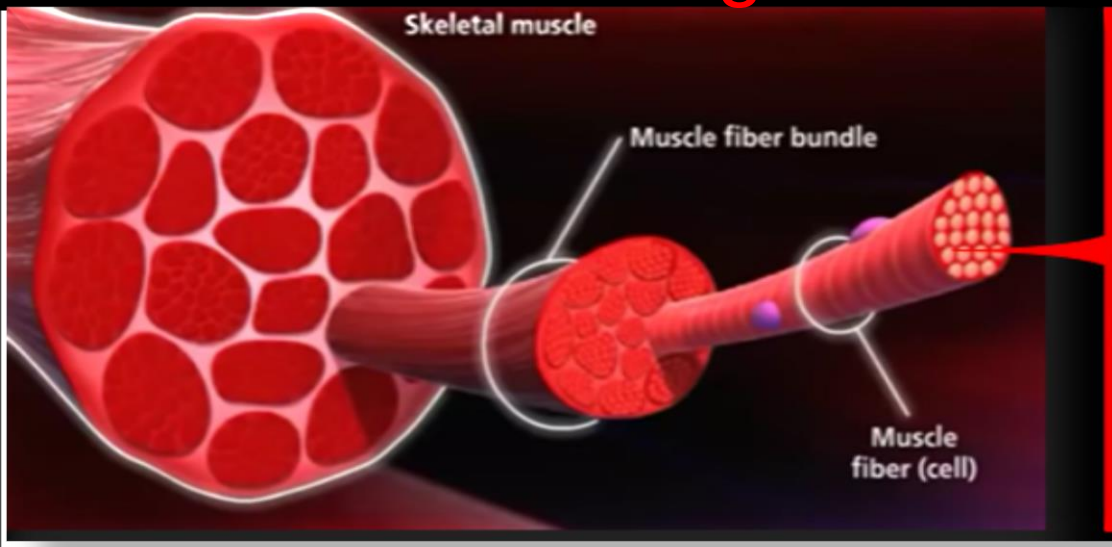
  } Hydration status prior dehydration?

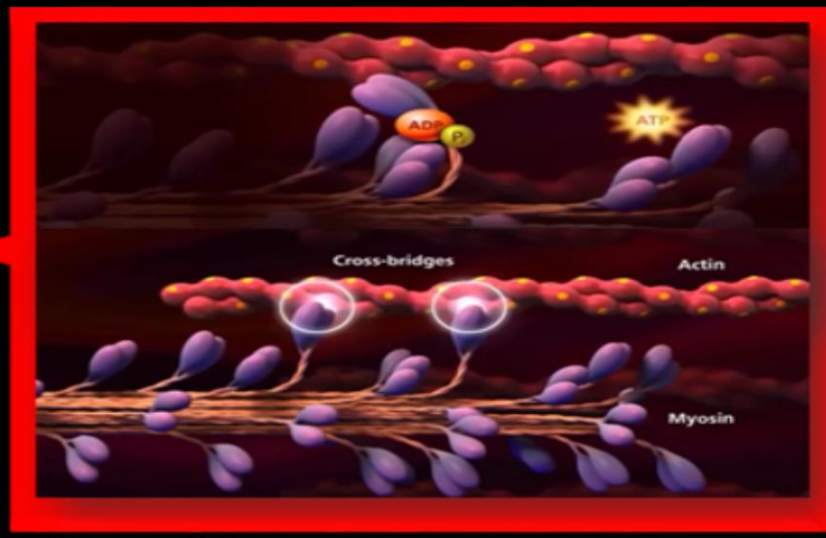
Degoutte et al. 2006; Horswill et al. 1990; Burge et al. 1993; Slater et al. 2005; Smith et al. 2000; Fogelholm et al. 1993; Artioli et al. 2010; Fileire et al. 2000; Koutedakis et al. 1994; Garthe et al, 2010; Koral & Dosseville 2009; Hall & Lane 2001; Webster et al. 1990; Finn et al. 2004

Protein metabolism and training adaptation



Metabolic mechanism for changes in muscle mass



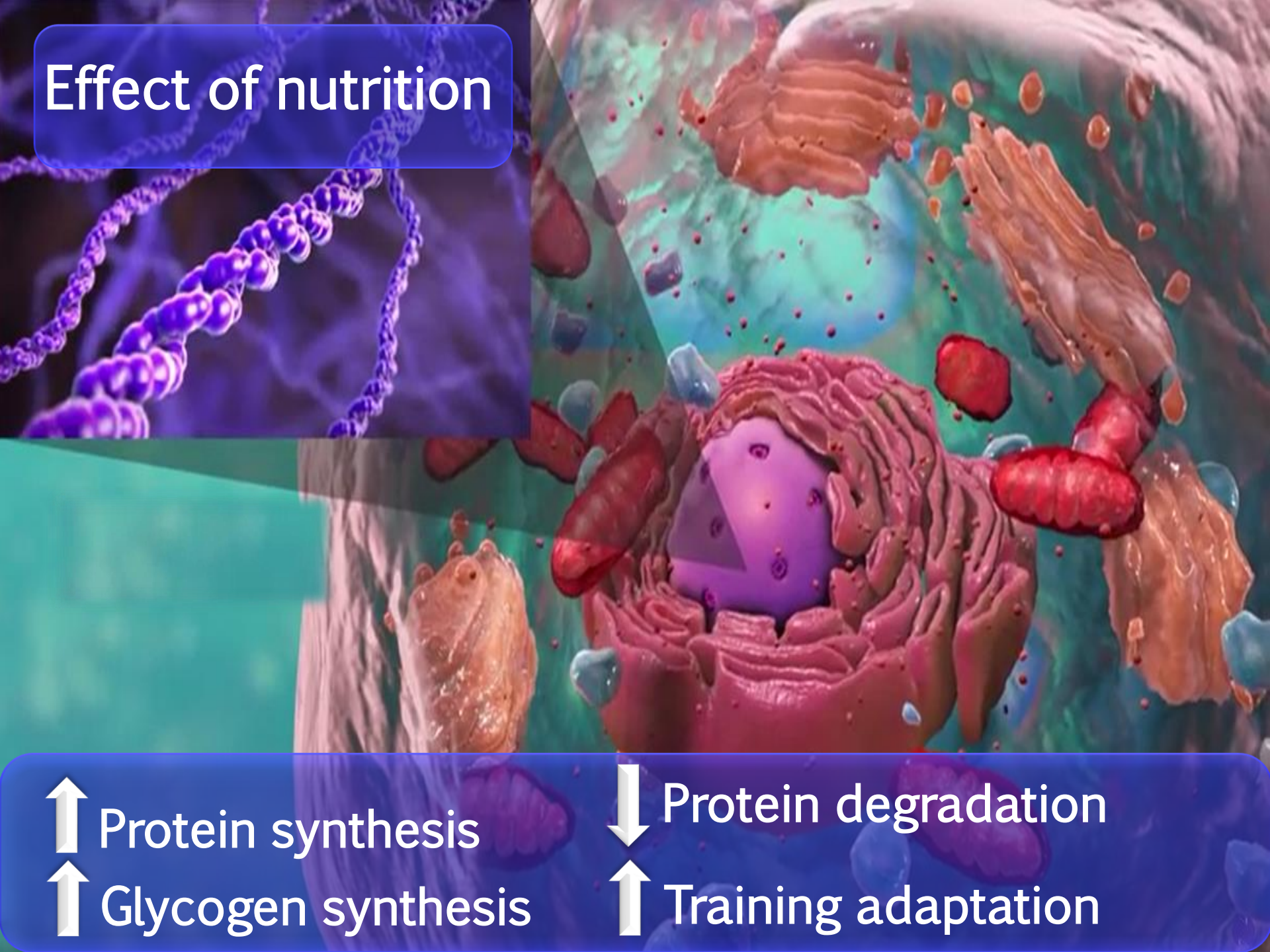


Muscle protein synthesis - muscle protein degradation = net muscle protein balance → no change in muscle mass

Muscle protein synthesis < muscle protein degradation = negative muscle protein balance → decreased muscle mass

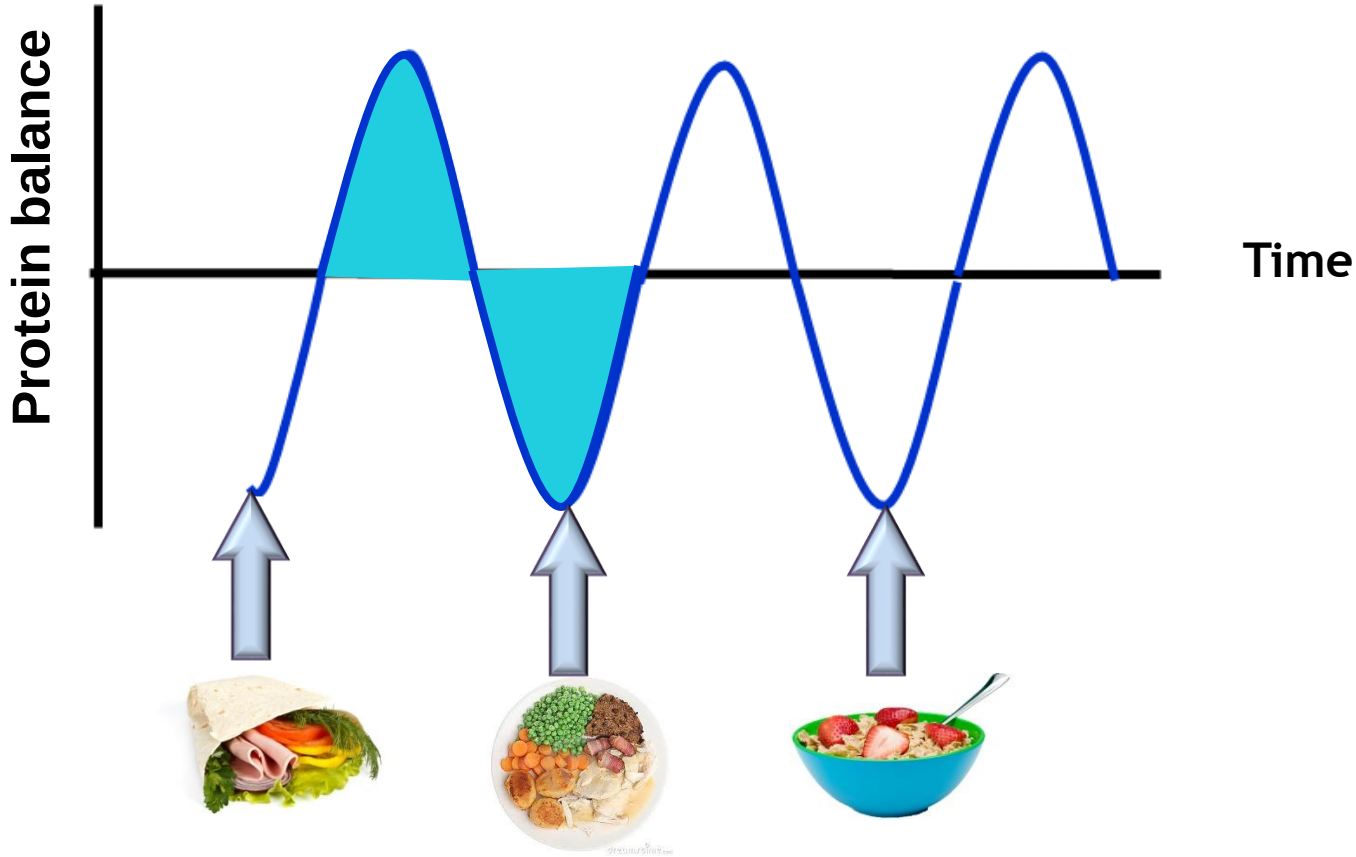
Muscle protein synthesis > muscle protein degradation = positive muscle protein balance → increased muscle mass

Effect of nutrition



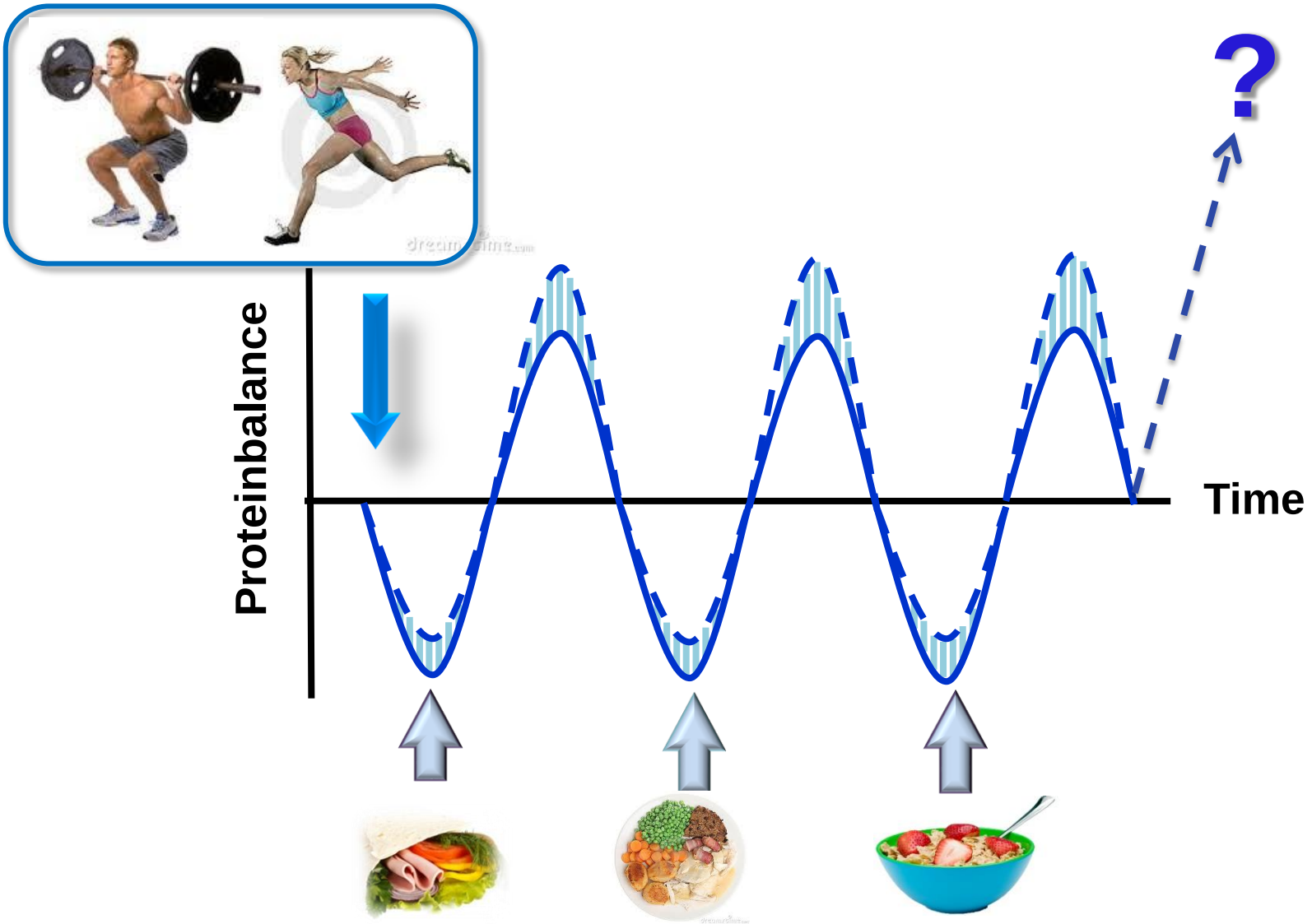
- ↑ Protein synthesis
- ↑ Glycogen synthesis
- ↓ Protein degradation
- ↑ Training adaptation

Protein metabolism



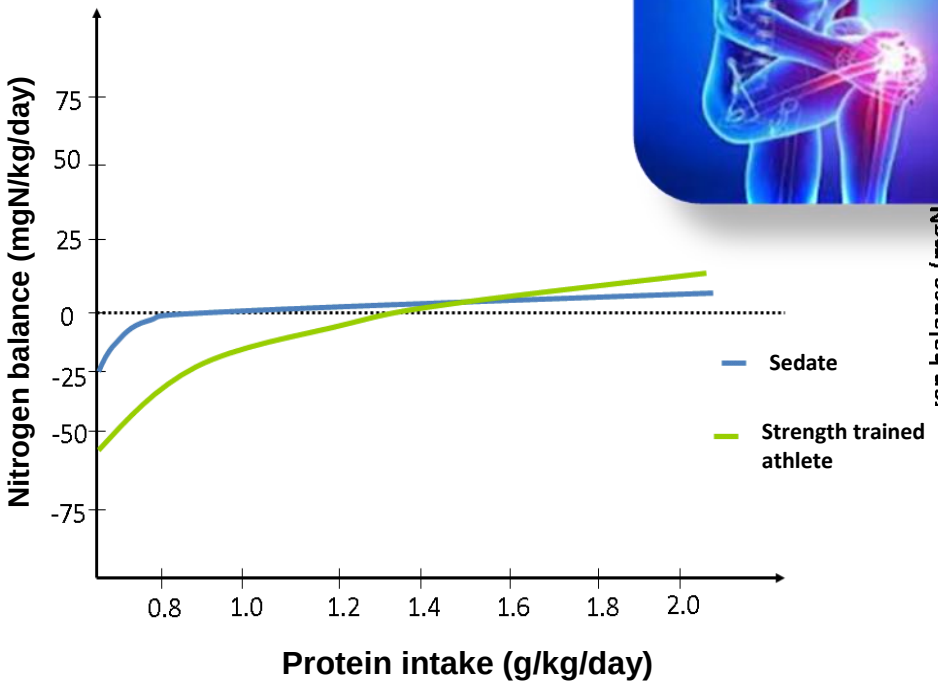
Phillips et al. 2005

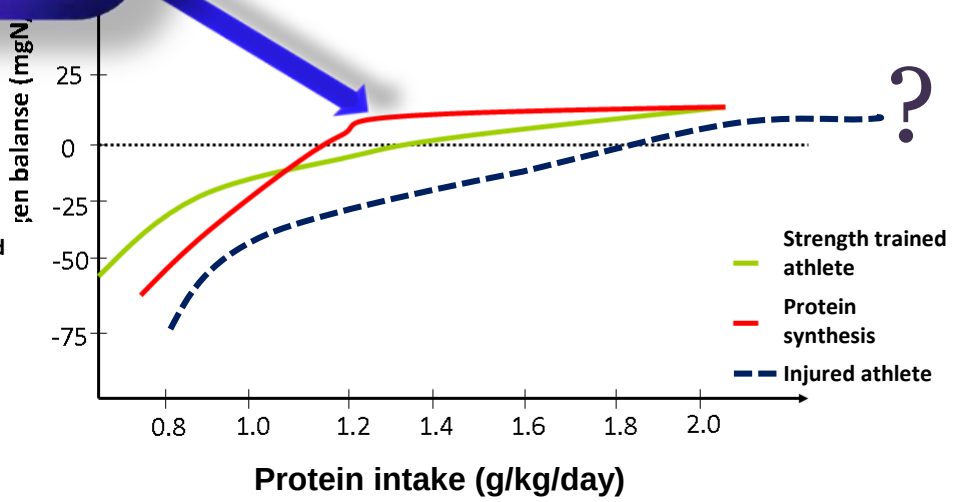
Protein metabolism



Phillips et al. 2005

Daily protein requirements

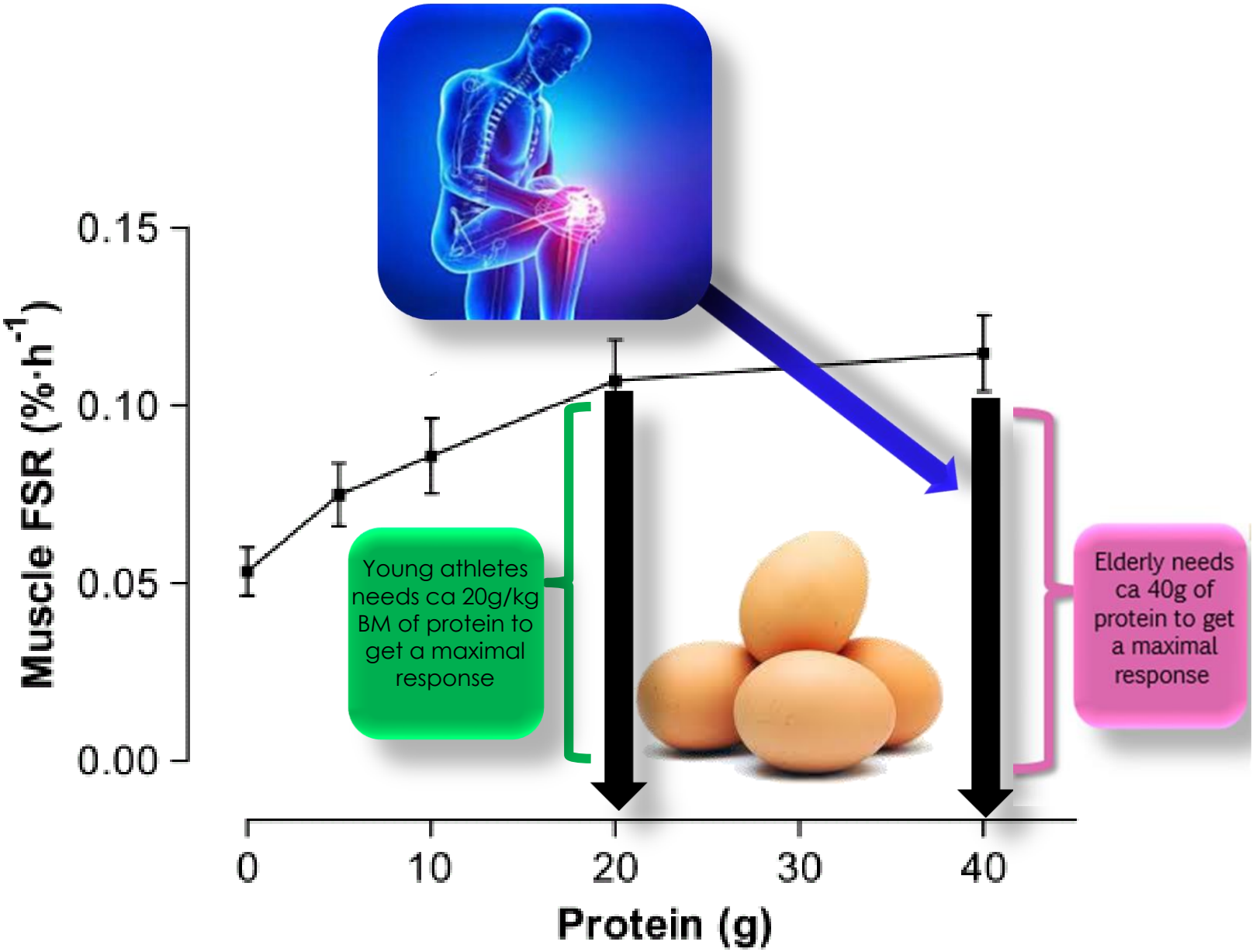




Sedentary: 0,8 g per kg body weight
Athletes: 1,4–1,8 g per kg body weight
Injured athlete: >2 g per kg body weight?

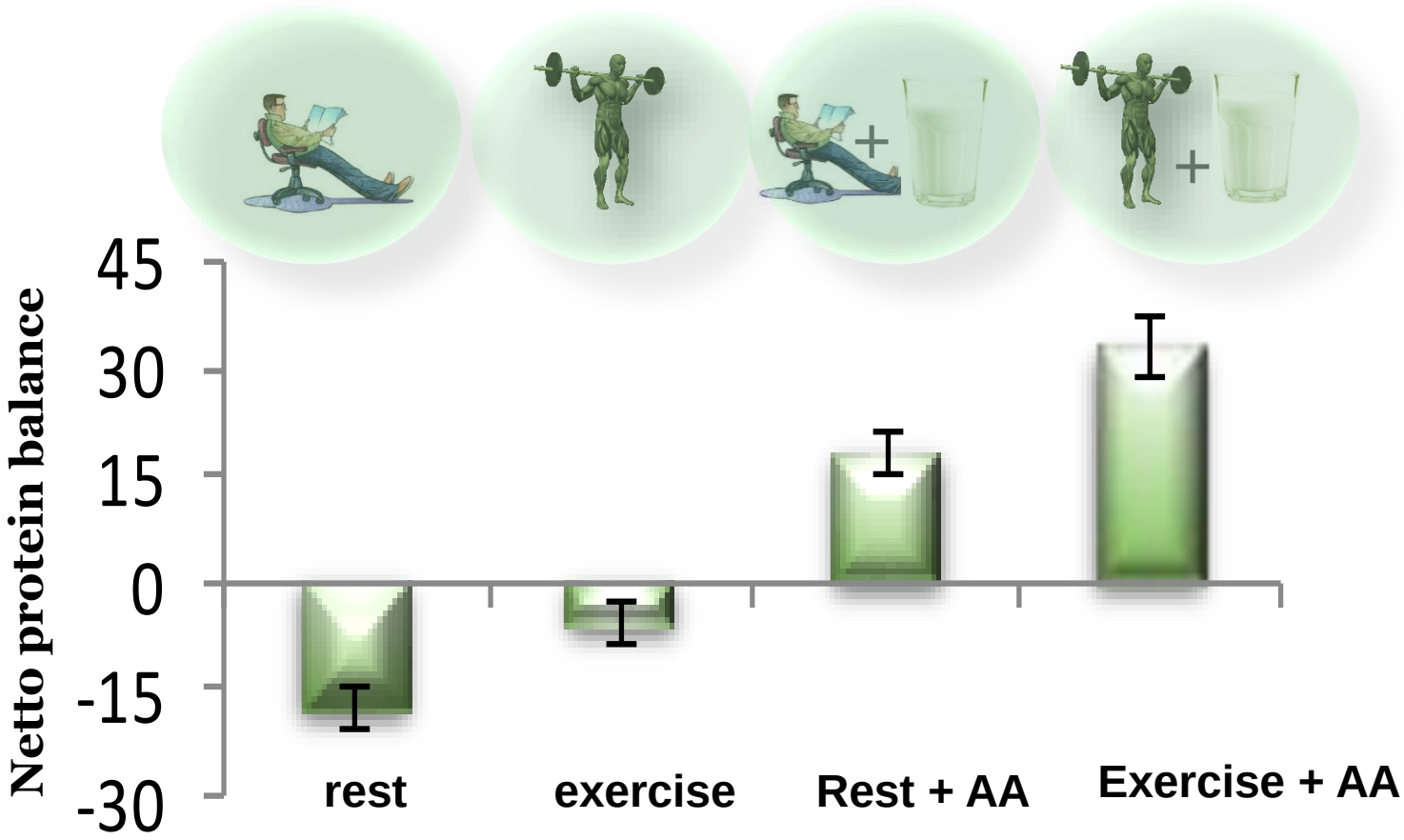
Tarnopolsky et al. 1992 (modified)

Protein requirements for maximal meal response



Moore et al. 2009; Pennings et al. 2012

Protein metabolism

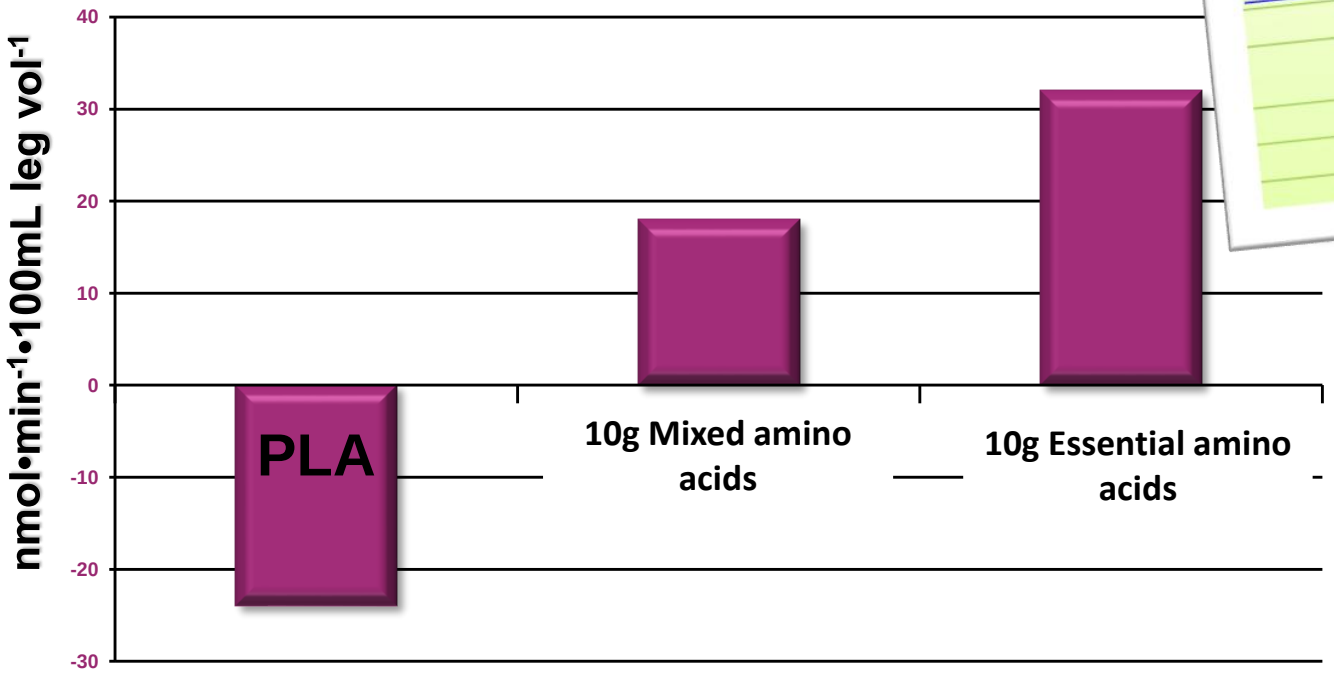


Biolo et al. 1995, 1997

Essential AA determines the anabolic response

- There are 20 different amino acids
- 9 are considered essential
- Leucine “key AA”

Essential	Nonessential
Histidine	Alanine
Isoleucine	Arginine*
Leucine	Asparagine
Lysine	Aspartic acid
Methionine	Cysteine*
Phenylalanine	Glutamic acid
Threonine	Glutamine*
Tryptophan	Glycine
Valine	Ornithine*
	Proline*
	Selenocysteine*
	Serine*
	Taurine*
	Tyrosine*



Tipton et al. 276:E628, 1999

Protein metabolism

20.00-21.00

+

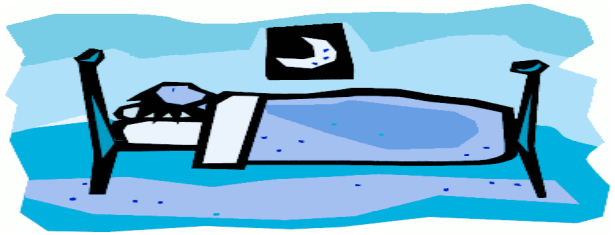
21.00

+

23.00

+

23.00-06.30



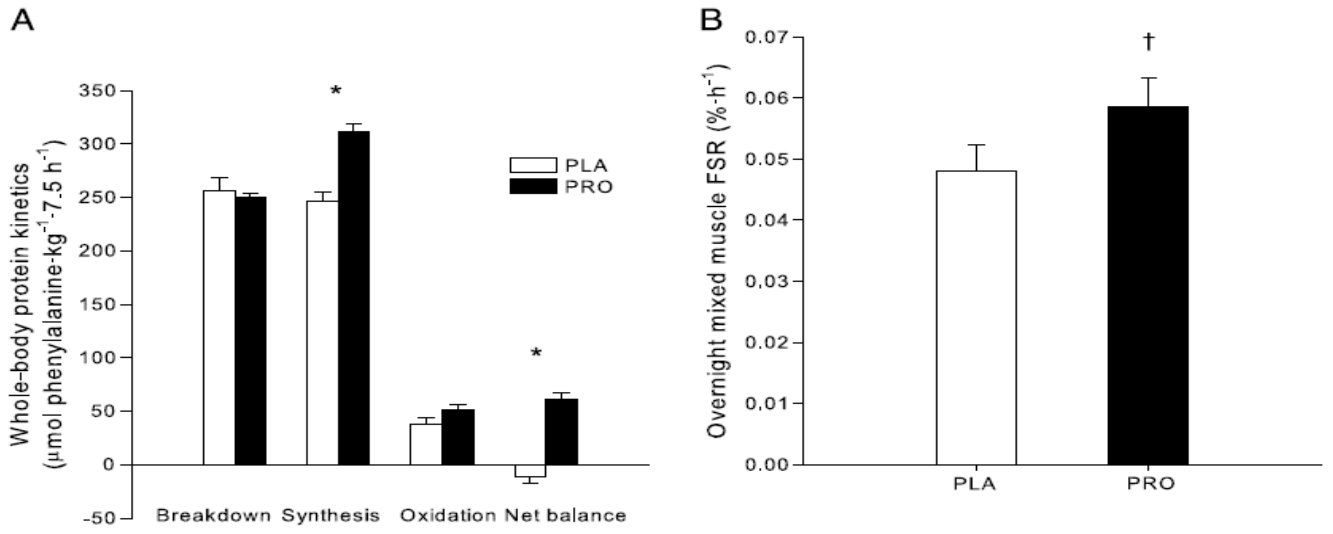
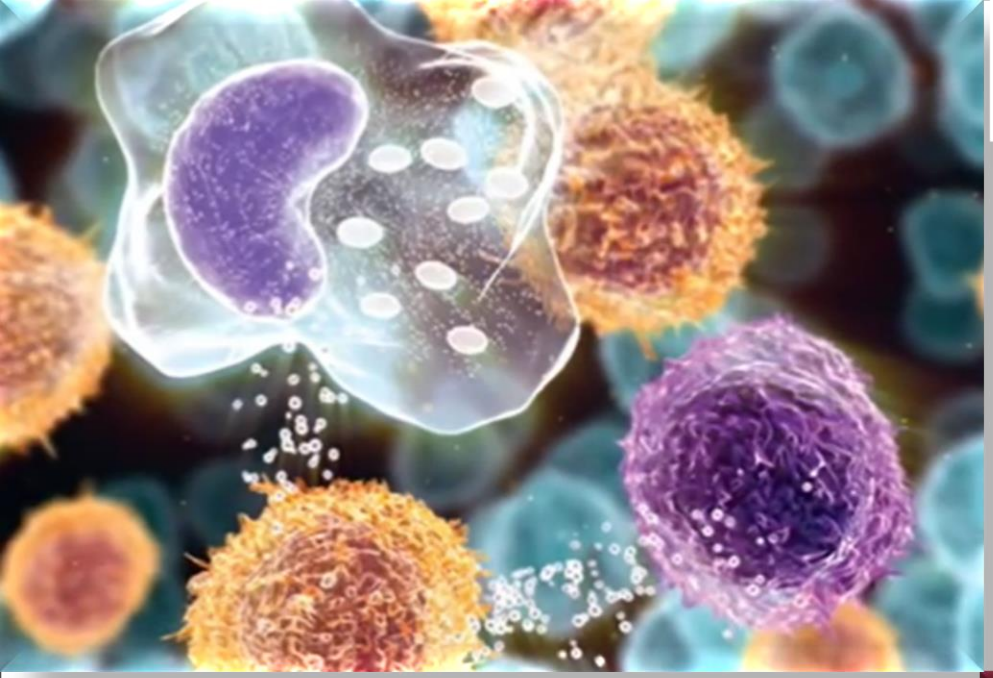


FIGURE 5—A, Rates of whole-body protein breakdown, synthesis, and oxidation rates and net protein balance (expressed as micromoles of phenylalanine per kilogram per 7.5 h) in the PRO and PLA experiments measured during the 7.5 h of overnight recovery. B, Mixed muscle protein FSR during overnight recovery (0–7.5 h) in the PRO and PLA experiments using average plasma [ring-$^2H_5$]phenylalanine enrichment as a precursor. A tendency toward higher FSR values in the PRO versus the PLA experiment was observed during overnight recovery. Values represent means ± SEM. Data were analyzed with an unpaired Student's *t*-test. *Significantly different from PLA ($P < 0.05$); †different from PLA ($P = 0.05$). PRO, protein experiment; PLA, placebo experiment.

Full-contact sports and soft tissue injuries - implications for recovery and adaptation?

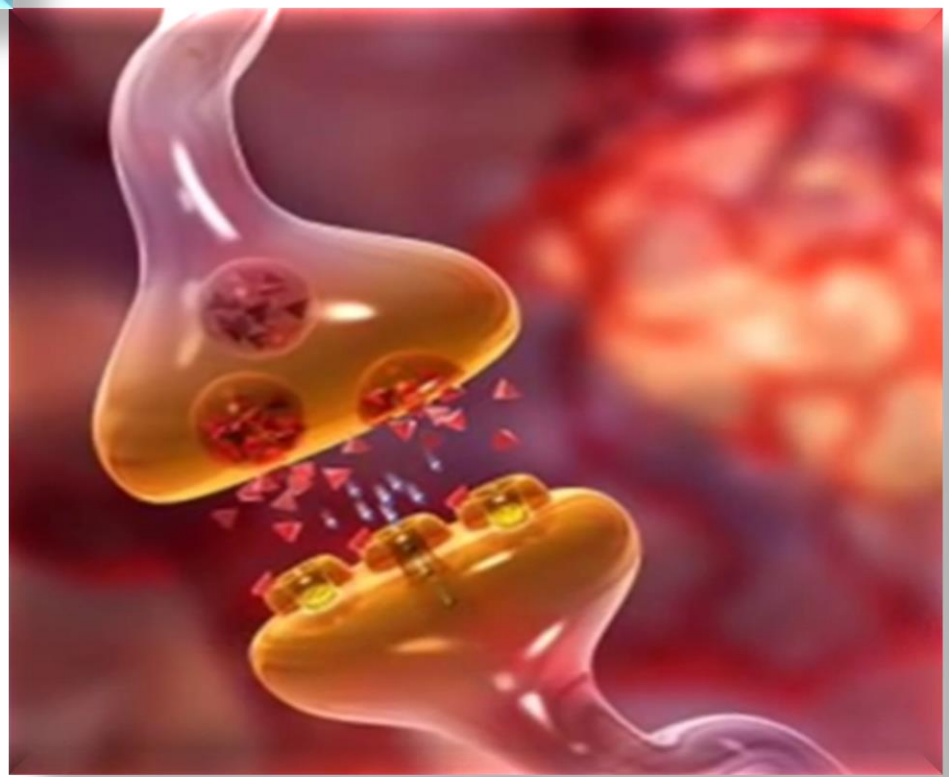


Inflammatory response

OLYMPIATOPPEN

- Activation of many processes that are crucial for optimal healing
- Few hours to several days depending on the type and severity of the injury

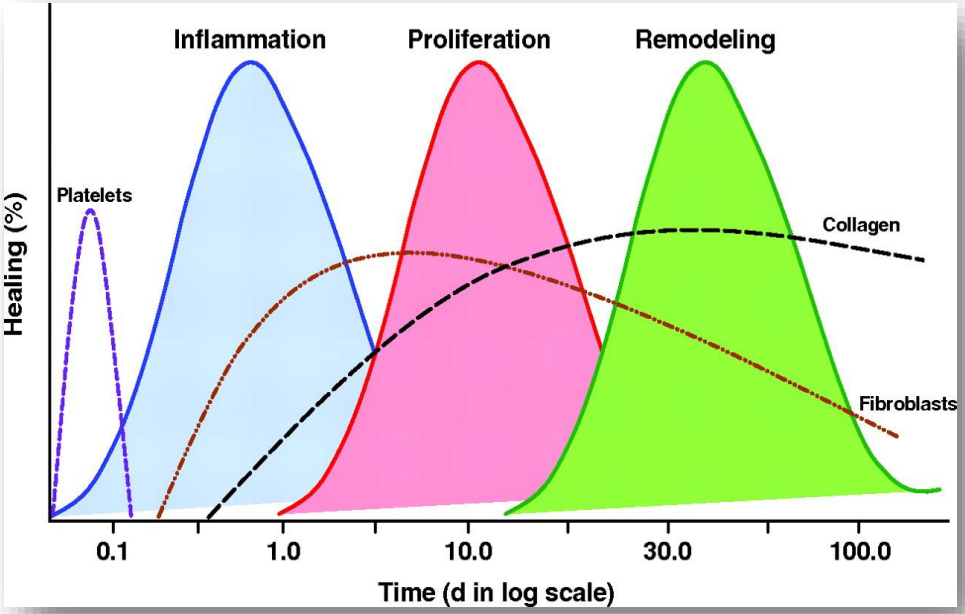
- Nutritional interventions intended to reduce inflammation may be contra-indicated
- Careful consideration of the appropriate approach to managing inflammation
- 4g omega-3 recommended 0-8 week?

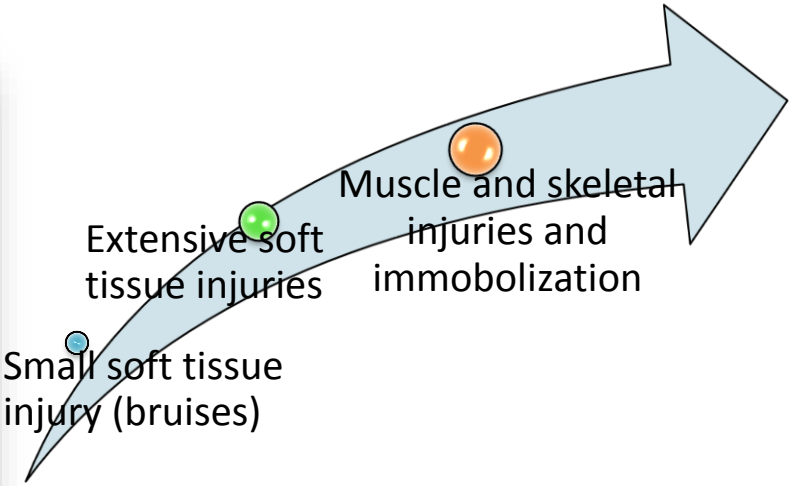


Slater, Pyne & Tipton in: Burke & Deakin 2015; Wall et al. 2014

Stages in the process of healing

- Stage 1: Inflammatory response
- Stage 2: Proliferation
- Stage 3: Recovery and remodeling

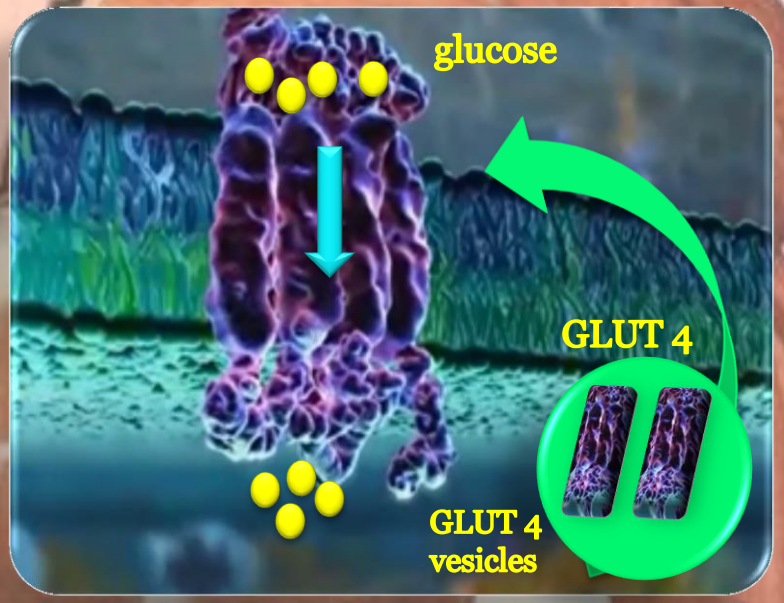


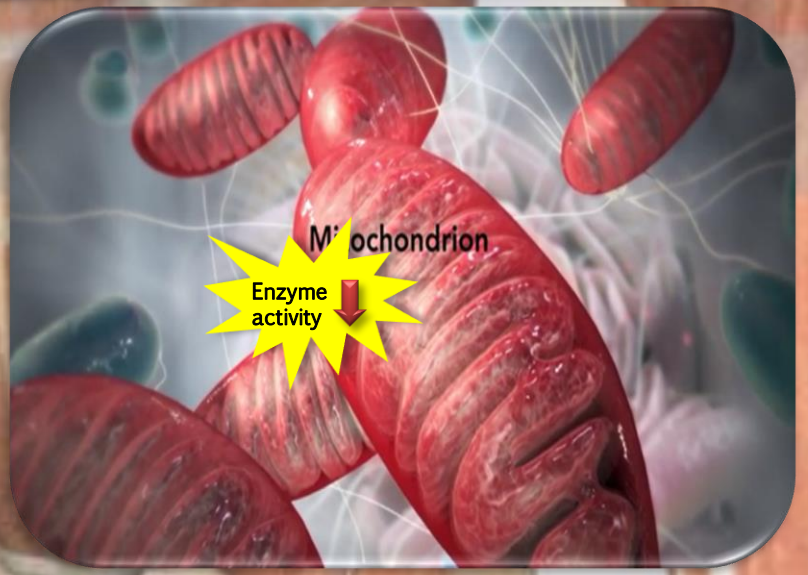


Slater, Pyne & Tipton in: Burke & Deakin 2015; Wall et al. 2014

Injuries and recovery

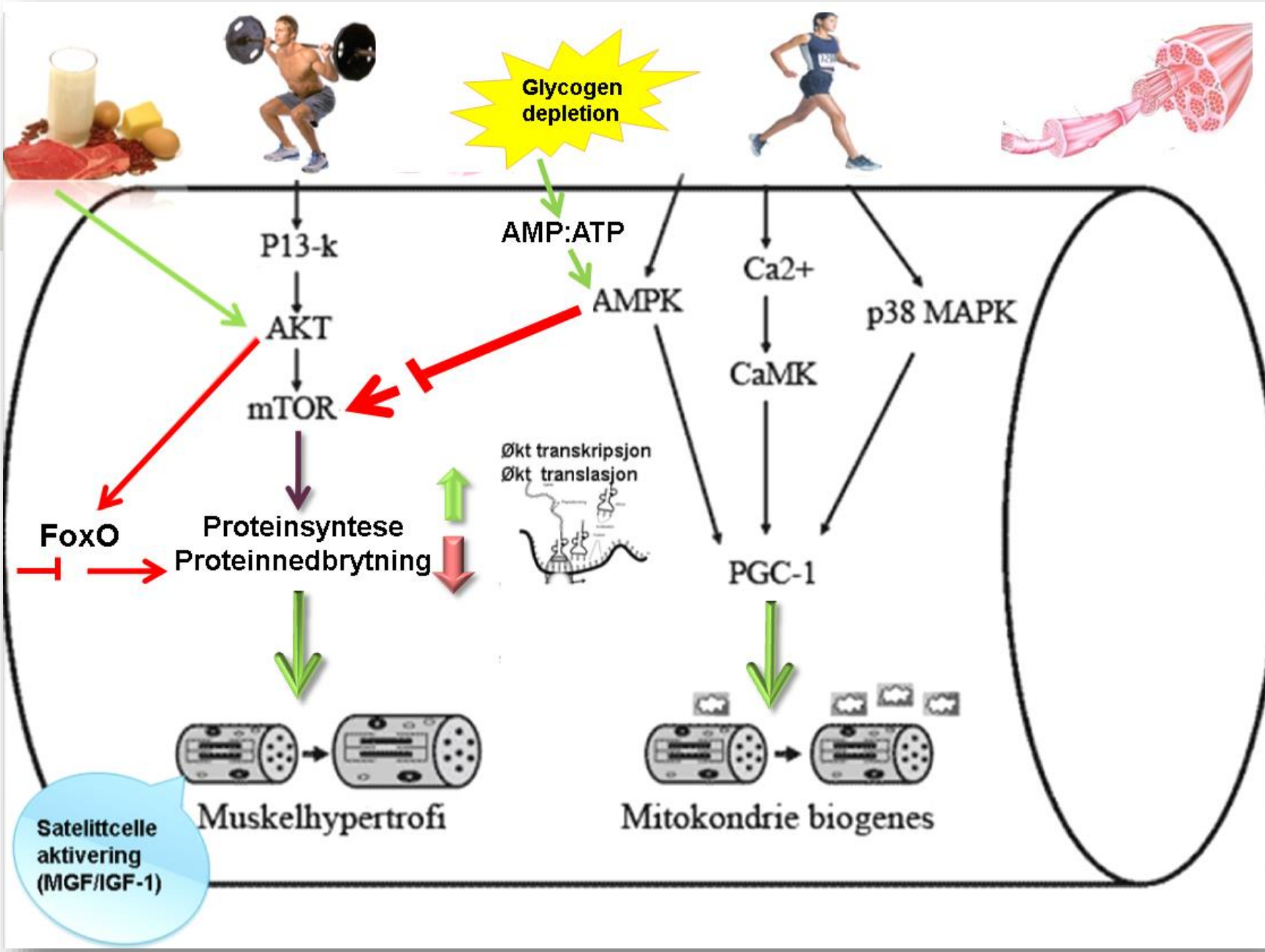
- Soft-tissue injuries
  - Response of MPS to amino acid may be reduced
- Muscle damage
  - Causes disruption to GLUT4 translocation and glucose transport into muscle is impaired
  - Decreased insulin sensitivity of muscle
- Down regulation of mitochondrial protein transcription?
  - Decrease in translational signalling pathways involved in mitochondrial biogenesis and declines in mitochondrial enzyme activities





Slater, Pyne & Tipton in: Burke & Deakin 2015; Wall et al. 2014

How to maximize training adaptation and recovery?


Glycogen depletion
P13-k
AKT
mTOR
AMP:ATP
AMPK
Ca2+
CaMK
p38 MAPK
FoxO
Proteinsyntese
Proteinnedbrytning
Økt transkripsjon
Økt translasjon
PGC-1
Muskelhypertrofi
Mitokondrie biogenes
Satelittcelle aktivering (MGF/IGF-1)

EXERCISE (STMULI)

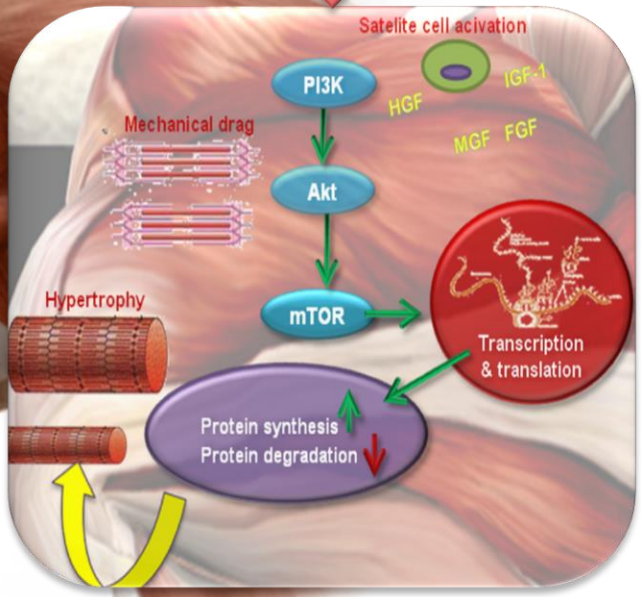
- Increased protein metabolism
- Physiological stressors
- Reduced glycogen storage
- Increased loss of body water and electrolytes
- Increased oxidative stress

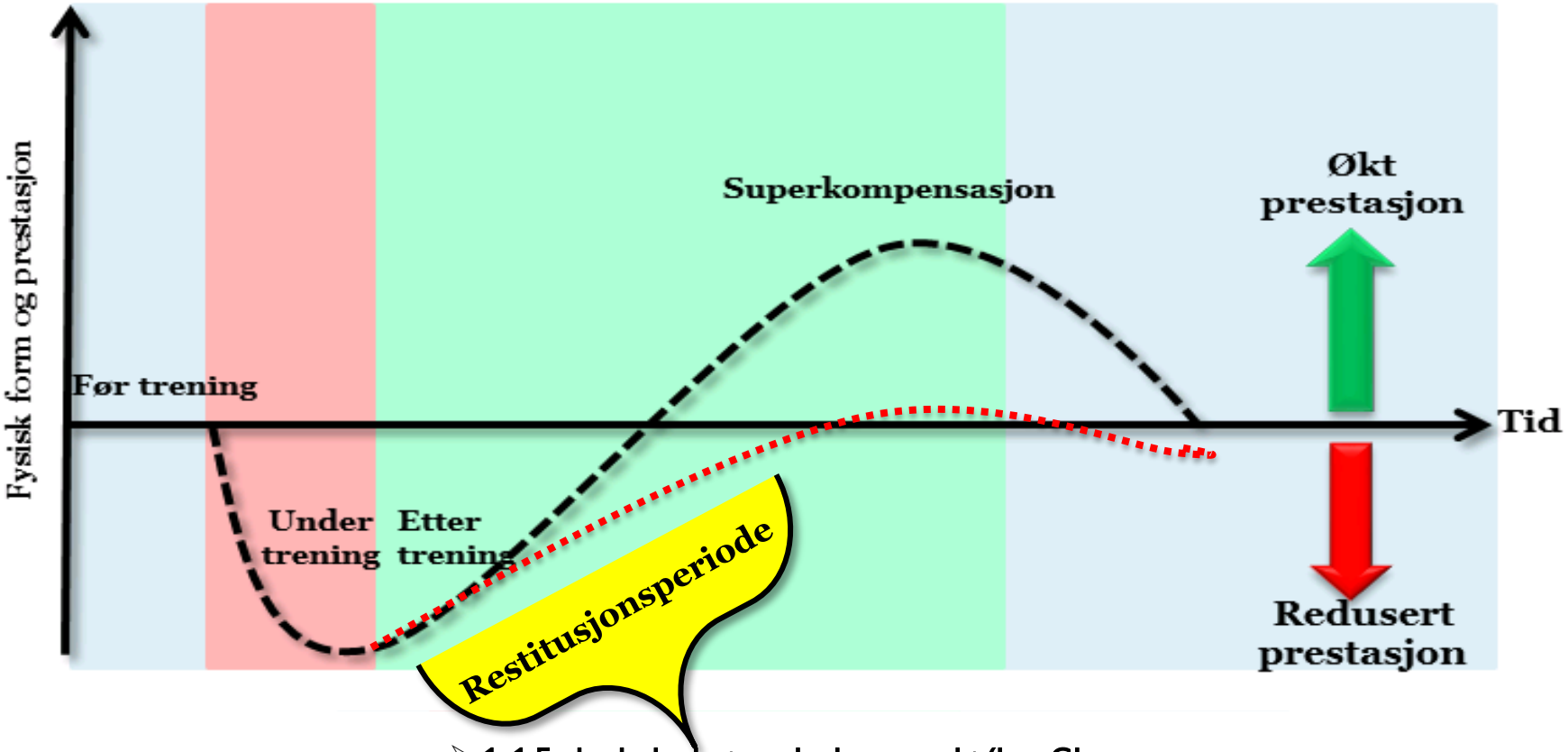
RECOVERY

- Refuelling glycogen in muscle
- Rehydrate
- Increased protein synthesis
- Repairmant of tissue

SUPER COMPENSATION

- Positiv net protein balance
- Increased lean mass
- Increased strength
- Physiological adaptations to stimuli





- 1-1,5g karbohydrat per kg kroppsvekt (høy GI dersom under 8 timer til neste økt
- Ca 20g protein (god proteinkilde med 40-50% essensielle aminosyrer)

~20g protein (ca 50% EAA) in every meal

Recovery meal after training: “fast” protein with leucine

Daily carbohydrate needs depends on the exercise type, intensity and frequency (4-8 g/kg body weight)

Res et al. 2012; Burke et al. 2012

Genetics always play a role

Anabolic response to strength training - genetic influence

Modifisert figur fra Dreyer et al 2008

The Elite Athlete
- fine line between success and failure

Stresses

Training
Family
Friends
Team mates
Pressure of competition
Financial

Recovery

Recovery time
Sleep
Diet
Time «off»
Sports psychology/ Mental training

Policy and guidelines based on research and practical experience

- Policy *supplements*
- Policy *weight regulation*
- Policy measuring *body composition*
- Policy and guidelines for *the younger athlete* *(growth, developement and different strategies in nutrition and exercise)*
- Policy and guidelines for *restricted training and competitions* in athletes with low energy availability

«For an ethical and healthy sport»

- Tailored sports nutrition
- Responsibility for established routines
- Ergogenic aids
- Weight manipulation

- Knowledge about puberty changes and how that may influence performance
- Increased cooking skills, energy needs, timing and recovery
- Athlete developes good routines and gradually take responsibility for preparing and timing of meals

Basic nutrition

-Frequent meal pattern, variety, food to support growth and development

- Parent and coach facilitates and and are responsible, kids participates in cooking

Enjoyment of food

Thorough screening

- Age, hight
- Natural body weight
  - Weight history
  - (menstrual history)
- Body compo
- M
- Rea
- Motiv on



★ Competition

Periodization of training

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Phase	Off-season	Pre-season		In-season						Active rest	Off-season	
Training duration & intensity	Duratio											
	Intensit											
	Strateg											
Nutrition	Overall											

1) No meal plan, increase body weight 65-67kg

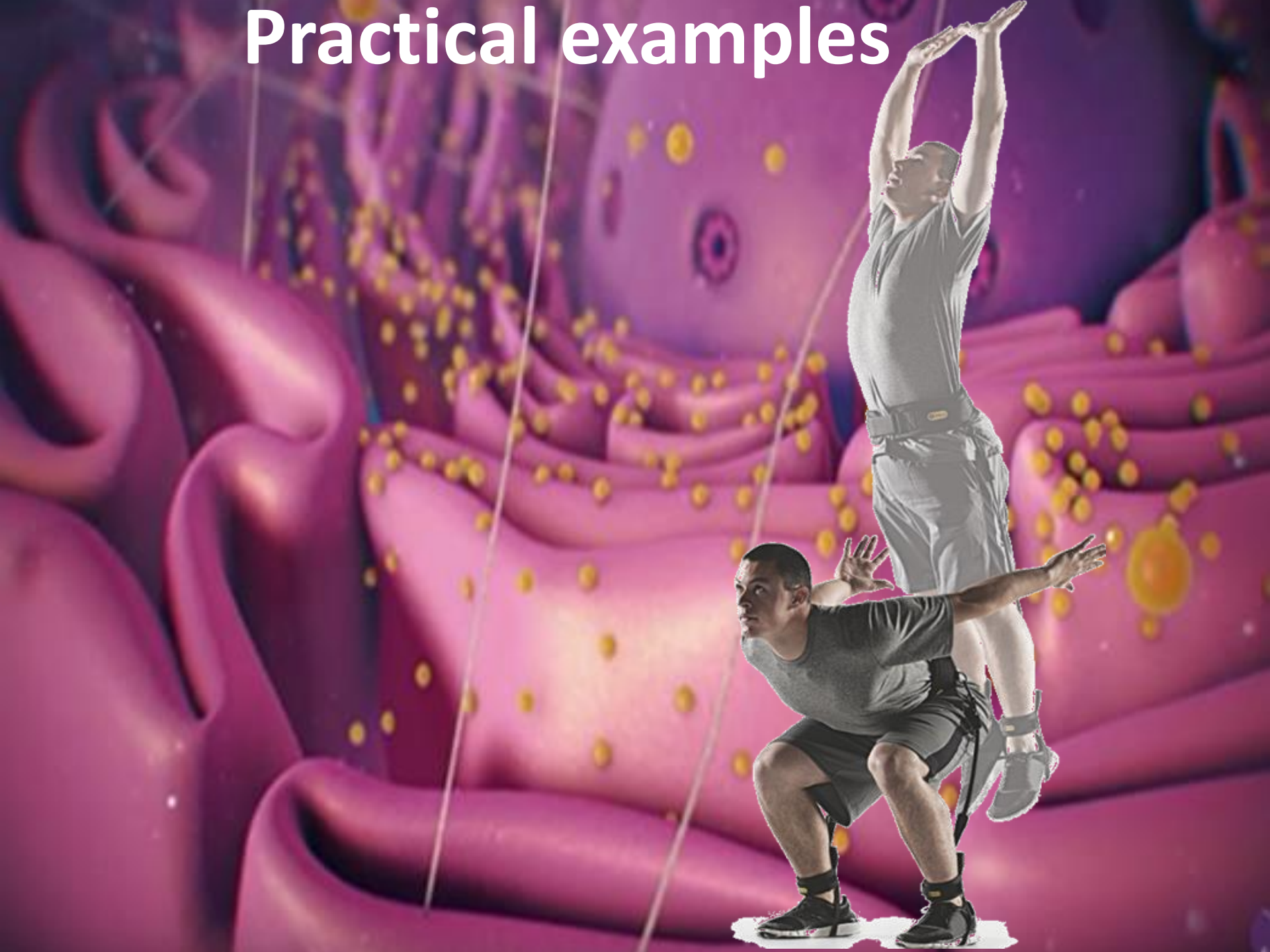
2) Mental and physical relaxation and recovery
Burgers and coca-cola

☺



Periodization of nutrition

Practical examples



Gradual weight loss

- 0.5-1 kg/week
- Reduced energy intake: 500-1000 kcal/day
- Lowest energy intake: 1500 kcal
- Limits fat%: 5-7 (males) and 12-14 (females)

Smart food choices (500 kcal)

OLYMPIATOPPEN

2 slices of whole wheat bread with butter, chees and ham and vegetables

1 carrot

1 glas of juice

1 glas of low-fat milk

1 dl cereal

2 dl low-fat yoghurt

1 banana

1 glas of juice

1 potato chips (100 g)

1 chocolate (100 g)

1 hot dog

0,5 l Coca Cola

Energy %

- 60% carbohydrate
- 20% protein
- 20% fat

- Protein intake:
  - minimum 1,4 g kg/bw per day
  - During weight loss: ca 1,8-2,5 g kg/bw per day

- Carbohydrate intake:
  - 4-8 g carbohydrate kg/bw per day
  - Differences depending on the sports specific demands

Practical suggestions

- Reduced energy from fat
- Increased intake of fiber
- CHO with low GI
- Focus on iron, calcium and essential fatty acids
- Protein in every meal
- Increased intake of fruit and vegetables
- Supplements
  - Multivitamin and omega-3 fatty acids
- Drink water before, during and between meals

THE ROADMAP TO SUCESS

BREAKFAST

LUNCH

TRAINING

DINNER

SNACK

PRE-TRAINING MEAL

RECOVERY MEAL

20g of protein


1 yoghurt og 1 glass smoothie


100g Kylling


1 glass melk og en brødskive med skinke


3 dl Biola og knekkebrød med cottage cheese


100g laks


Sandwich med ost og skinke


1 YT


150g egg


1 YT


150g cottage cheese


5 dl smoothie


2 store egg

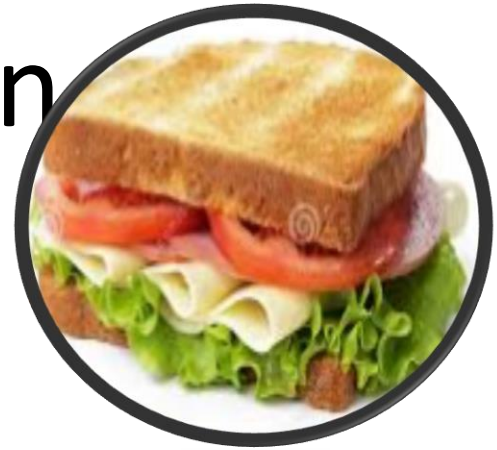

5 dl sjokolade-melk

4 dl Styrk Melk


1 egg og 3 dl smoothie

- Foods containing high quality protein
  - ≥ 50% EAA + 30-50g CHO
  - Filet of red and white meat, fish, milk products, egg
  - E.g., 5 dl of chocolate milk ~ 10g EAA
  - Cow's milk is 20% whey protein and 80% casein protein
- How important is timing of intake related to exercise?
  - High frequency meal pattern with high quality protein
  - Meal before and after exercise will optimize protein metabolism
- Supplements may be practical and convenient for athletes some situations
  - Travelling, competitions, periods of high energy demands
  - Combination products (carbohydrate + protein)
- Cost/benefit evaluation of taking supplements
  - Low-risk supplements to avoid **positive doping test**

The day before weigh-in



- Foods high in energy and CHO
  - Bread, cereal, yoghurt, dinner

- Avoid fat, spicy and salty food
  - Water retention

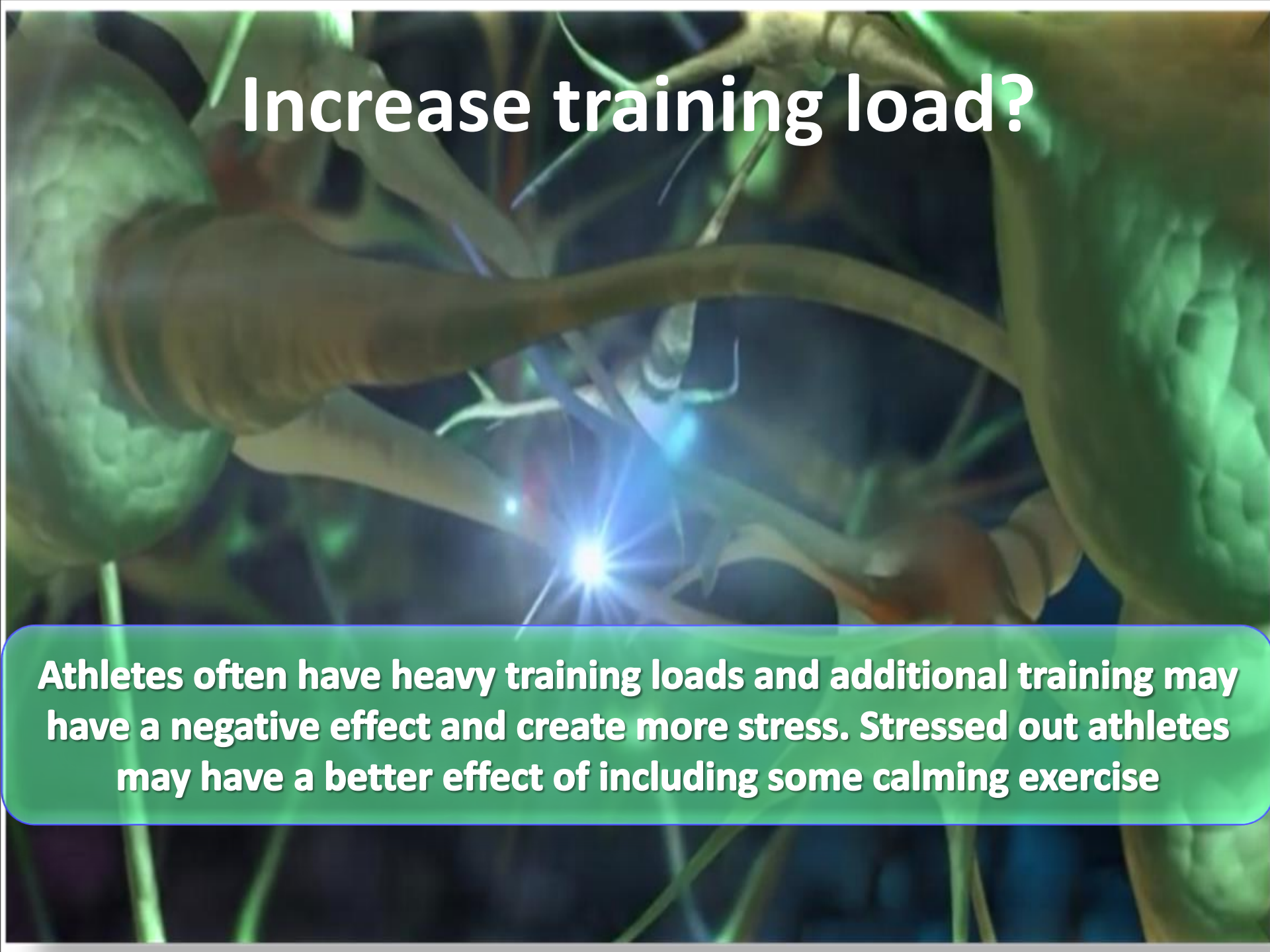
- Drinks high in energy
  - Juice, cordial, milk

- Strength training
  - Stimuli for LBM growth

- Split one longer session in to two
  - EPOC, metabolism, quality

- “Recovery” endurance training
  - Warm-up, cool-down
  - Increase blod-flow

Increase training load?



Athletes often have heavy training loads and additional training may have a negative effect and create more stress. Stressed out athletes may have a better effect of including some calming exercise

Weigh-in

- Consider if it is possible to eat and drink something before weigh-in
- Most important after weigh-in is to rehydrate
- Drink 1-2 liter
  - Sportsdrinks with electrolytes
  - Replace 150% of weight loss

- Eat and drink as much as you can tolerate
- Frequent small meals
- Easy digestible food
- Frequent meal pattern during competition day

Most important recovery period:
- Hours between weigh-in and competition

Goal:
rehydrate and refueling of glycogen storage

- Dinner (frequent small portions, high CHO, easy digesting food)
- Evening meal
- Snacking and fluid intake (ca 4l total) in between

Refractometer: urine samples to monitore rehydration (urine specicic gravity)

Competition

- Frequent snacking
- High in CHO
- Sports drink
- Sportsbar
- Nutridrink
- Food (e.g. pasta, sandwiches, raisins)





Take home

Weight-class athletes

- Weight loss is a challenge we have to talk about and deal with in Elite Sports
- Weight loss may impair health and performance and should be guided by professionals
- Tailor weight loss intervention for each athlete
- Time the mealplan for best adaptation and recovery

GOOD LUCK WITH THE GAMES!