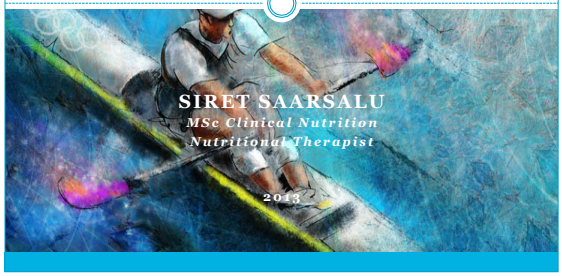
Nutrition at Different Phases of the Training Program



Background

MSc Clinical Nutrition
- University of Hohenheim, Germany
- ETH Zurich, Switzerland

Registered nutritional therapist

OÜ Nutrilligent
- Sports nutrition
- Nutritional therapy

Amateur rower

NUTRILLIGENT

Outline

- Introduction
- Current dietary recommendations for athletes
- Nutrition periodization
- Specific nutritional supplements commonly used by rowers

Traditional periodization

Four main macro-cycles:
- General preparation phase
- Specific preparation phase
- Competition phase
- Transition phase

The training stimuli during these different phases can differ drastically in terms of intensity and volume

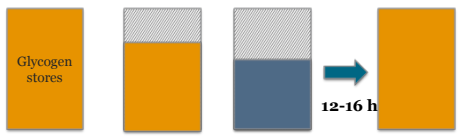
⇒ The types of fuels and the amount of energy during these phases need to be addressed through a periodized nutritional approach

Goals of nutrition periodization

- Body fat loss
- Weight loss/gain
- Support immune health
- Support physical periodization
- Improve performance

To support the body's energy needs associated with the different training volume and intensity stressors throughout the training year to elicit positive physiological responses

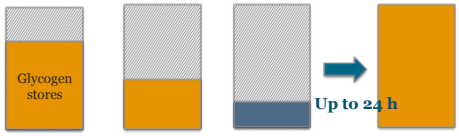
Athlete with periodized nutrition



Pre Exercise | During Exercise | Post Exercise

Athlete without periodized nutrition

7



Pre Exercise | During Exercise | Post Exercise

8

"Recovery nutrition begins before a training session starts."

B. Seebohar

U23 rower

9

Time	Meal
7.00 Breakfast	Bowl of porridge with jam Coffee
11.45 Lunch	Omelette (2 eggs, milk) Cheese (55 g) Chicken nuggets (42 g)
15.40 Snack	Banana-chocolate pastry
17.00 Snack	Quark Crème, 2.5% (200 g)
18.00-19.50 Training	Concept II (3x 4000m at AT)
21.30 Dinner	Quark Crème, 2.5% (200 g) Banana
22.00 Snack	Cheese (60 g)

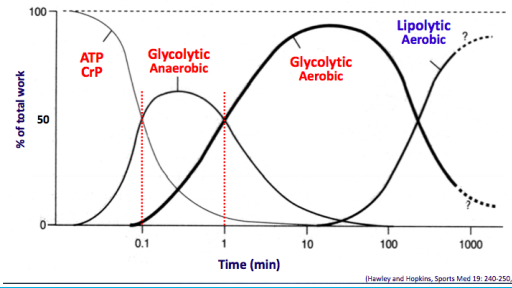
Food calories ~1900 kcal
Calories used ~3100 kcal
Energy balance -1200 kcal!

CHO 2.3 g/kg
PRO 0.86 g/kg
FAT 1.2 g/kg

Body fat 27%
Poor recovery
Often ill

Energy delivering substrates

10



Estimated energy stores in humans

11

Male, 75 kg
Body fat 20%
(Male athlete max. 10% body fat)

Adipose tissue	~80 000 kcal
Muscle triglycerides	~2 500 kcal
Glycogen (liver)	~400 kcal
Glycogen (muscle)	~1 500 kcal
Glucose (blood)	~80 kcal
Muscle protein	~30 000 kcal

→ The capacity of our body to store glycogen is limited

S. G. Eberle. Endurance Sports Nutrition, 3rd Edition

Carbohydrates (CHO)

12

Total carbohydrates

Moderate volume intense training (2-3 h/d, 5-6 d/wk)	5 - 8 g/kg/d
High volume intense training (3-6 h/d in 1-2 workouts, 5-6 d/wk)	8 - 10 g/kg/d
Extreme volume intense training (4-6+ h/d)	10 - 12+ g/kg/d

Carbohydrates before, during and after training

1-4 h before training session	1 - 4 g/kg
During training session	0.5 - 1 g/kg
After training session	0.8-1.2 g/kg

75-80% complex carbohydrates and 20-25% simple carbohydrates (sucrose, fructose, glucose etc)

Kreider et al. JISSN 2010, 7:7

Protein (PRO)

13

Protein	max 2-3 g/kg/d
General fitness program	0.8-1.0 g/kg/d
Moderate volume intense training	1.0-1.5 g/kg/d
High volume intense training	1.5-2.0 g/kg/d

Foods that provide approximately 10 g of protein:

Animal foods	Plant foods
2 small eggs	4 slices bread
30 g reduced fat cheese	90 g whole grain cereal
70 g cottage cheese	330 g cooked pasta
1 cup low fat milk	400 g cooked rice
35 g lean beef, lamb or pork	150 g lentils or kidney beans
40 g chicken	120 g tofu
50 g fish	60 g nuts of seeds
200 g reduced fat yoghurt	1 cup soy milk

Kreider et al. JISSN 2010, 7:7

Fat

14

2P Polyunsaturated fatty acids:
- 1 part Omega-3:
  - ✓ Chia and flax seeds
  - ✓ Hemp seeds and oil
  - ✓ Walnuts
  - ✓ Oily fish (salmon, herring etc.)
- 1-2 parts Omega-6:
  - ✓ Sunflower oil
  - ✓ Grape seed oil
  - ✓ Corn oil
  - ✓ Meat

3P Monounsaturated fatty acids:
- Omega-9:
  - ✓ Olive oil
  - ✓ Almond and sesame oil
  - ✓ Avocado
  - ✓ Peanuts, almonds

**25-30% fat of total energy*
0.8-3.0 g/kg

2P Saturated fatty acids:
- ✓ Chocolate
- ✓ Meat
- ✓ Dairy products
- ✓ Coconut oil

Trans fatty acids (avoid):
Hydrogenated vegetable oil
- ✓ Fast food
- ✓ Processed food (cakes, pies)
- ✓ Chips, crackers, cookies
- ✓ Processed meat (hot dog)
- ✓ French fries, chicken nuggets
- ✓ Margarine

Kreider et al. JISSN 2010, 7:7
P. Holford. The Optimum Nutrition Bible. 2009

U23 rower

15

Time	Meal
7.00 Breakfast	Bowl of porridge with jam Coffee
11.45 Lunch	Omelette (2 eggs, milk) Cheese (55 g) Chicken nuggets (42 g)
15.40 Snack	Banana-chocolate pastry
17.00 Snack	Quark Crème, 2.5% (200 g)
18.00-19.50 Training	Concept II (3x 4000m at AT)
21.30 Dinner	Quark Crème, 2.5% (200 g) Banana
22.00 Snack	Cheese (60 g)

Food calories ~1900 kcal
Calories used ~3100 kcal
Energy balance -1200 kcal!

CHO 2.3 g/kg
PRO 0.86 g/kg
FAT 1.2 g/kg

Body fat 27%
Poor recovery
Often ill

U23 rower

16

Time	Meal
7.00 Breakfast	Porridge (whole grain) with jam or berries Sour milk Water or juice
10.00 Snack	Apple Walnuts
13.00 Lunch	Creamy chicken pasta with broccoli Green salad Water or juice
16.00 Snack	Bread with cheese 1 Kiwi
18 – 20 Training	Sports drink (400-800 mL/h)
20.15 Snack	5 Dried figs 150 g Ricotta
21.30 Dinner	Lentils with salmon Green salad Water or tee

Food calories ~2600 kcal
Calories used ~3100 kcal
Energy balance -500 kcal!

CHO 4.0 g/kg
PRO 1.9 g/kg
FAT 0.8 g/kg

Macronutrient distribution

17

	CHO	PRO	FAT
Training cycle dependent	5- 12+ g/kg	1.0-2.0 g/kg	0.8-3.0 g/kg

Macronutrient distribution

18

Training cycle	CHO	PRO	FAT
Preparatory (no weight loss)	5- 7 g/kg	1.2-1.7 g/kg	0.8-1.0 g/kg
Preparatory (Weight loss)	3-4 g/kg	1.8-2.0 g/kg	0.8 g/kg
Competition	7-12+ g/kg	1.4-1.6 g/kg	0.8-1.5 g/kg
Transition	3-4 g/kg	1.6-2.0 g/kg	0.8-1.0 g/kg

Preparatory cycle goals

19

ENDURANCE / STRENGTH / FLEXIBILITY / …

- Body fat loss
- Iron rich foods/supplements
- Get to know the gastrointestinal (GI) system
- Improvement of the metabolic efficiency

Metabolic INefficiency

20

- How efficient is the body in utilizing carbs and fat at different intensities and durations?
- Poor utilization of fat stores
  - ⇒Increased reliance on carbohydrate limited stores
  - ⇒Increased need for supplemental carbohydrates
  - ⇒Inability to proberly feed during training/racing
  - ⇒Higher risk of GI distress

Training nutrition ranges: preparatory

21

Nutrient	Pre	During	Post
Fluid	1-2 L/day	400-800 mL/h	150% for water lost
Carbohydrate	Meal/light snack	None (at least in the first part of Prep)	Snack
Protein	Meal/light snack	None	Snack
Fat	Meal/light snack	None	Snack
Sodium	Meal/snack	Just enough to promote hydration	Min of 500 mg for every pound lost

Competition cycle goals

22

SPEED / POWER / ECONOMY / …

Build
- Race simulation eating
- Warm-up the gut
- Electrolytes and hydration

Race
- Fine-tune for types/distances
- Avoid temptation
- Recovery!!!

Training nutrition ranges: competition

23

Nutrient	Pre	During	Post
Fluid	1-2 L/day	400-800 mL/h	150% for water lost
Carbohydrate	Meal/light snack	30-90 g/h	Snack 0.8-1.2 g/kg
Protein	Meal/light snack	Debatable (gut response)	Snack 10-20 g
Fat	Meal/light snack	None	Snack
Sodium	Snack	500-700 mg/L of fluid	Minimum of 500 mg for every pound lost

Transition cycle goals

24

RECOVERY / PREHAB / FUN / …

- Manage emotions, manage intake
- Don't eat like an athlete
- Prevent weight/fat gain

Training nutrition ranges: transition

25

Nutrient	Pre	During	Post
Fluid	1-2 L/day	400-800 mL/h	150% for water lost
Carbohydrate	X	X	X
Protein	X	X	X
Fat	X	X	X
Sodium	X	X	Minimum of 500 mg for every pound lost

Post-workout nutrition (within first 30 min)

26

Long aerobic/ endurance training	Intense short duration or prolonged resistance circuit training	Technical drills/short duration resistance training	Situations of short recovery (< 4h)
CHO: ~0.8-1.2 g/kg PRO: ~0.2-0.4 g/kg FAT: ~0.2-0.3 g/kg	CHO: ~0.8-1.2 g/kg PRO: ~0.2-0.4 g/kg FAT: minimal requirements	CHO: ~0.5-1.0 g/kg PRO: ~0.2-0.4 g/kg FAT: minimal requirements	CHO: ~1.2-1.5 g/kg PRO: minimal requirements FAT: minimal requirements
Sports drink or juice, protein recovery bar, milk	Dried figs, ricotta, water	Fruit smoothie (with protein powder) and 1 piece of fruit	Sports drink or juice, sports bar, fruit

Stellingwerff, T., et al. J Sport Sci. 2011; 29 (S1): S79-S89
Beelen, M., et al. Int J Sport Nutr Exerc Metab. 2010; 20 (6): 515-32

Dietary supplements

27

Group A
Supported for use in specific situations in sport

Sports gels/drinks/bars
Liquid meal *Calcium and iron*
Multivitamins and vitamin D
Probiotics *Creatine* *Caffeine*
Bicarbonate

Group B
Deserving of further research

Carnitine *HMB*
Fish oil *β-Alanine*
Anti-oxidants C and E
Quercetin *Beetroot juice/Nitrate*
Probiotics for immune support

Group C
No meaningful proof of beneficial effects

BCAA *Arginine* *Magnesium*
Chromium picolinate *Ribose*
Vitamins outside A use
Coenzyme Q10 *Pyruvate* *Ginseng*
Glucosamine

Group D
Banned or at high risk of contamination

Australian Institute of Sport (www.ausport.gov.au)

Supplements

28

Group A
Supported for use in specific situations in sport

Sports gels/drinks/bars
Liquid meal *Calcium and iron*
Multivitamins and vitamin D
Probiotics *Creatine* *Caffeine*
Bicarbonate

Group B
Deserving of further research

Carnitine *HMB*
Fish oil *β-Alanine*
Anti-oxidants C and E
Quercetin *Beetroot juice/Nitrate*
Probiotics for immune support

Group C
No meaningful proof of beneficial effects

BCAA *Arginine* *Magnesium*
Chromium picolinate *Ribose*
Vitamins outside A use
Coenzyme Q10 *Pyruvate* *Ginseng*
Glucosamine

Group D
Banned or at high risk of contamination

Australian Institute of Sport (www.ausport.gov.au)

Dietary nitrates/Beetroot juice

29

- Sources of dietary nitrate:
  - Beetroot and green leafy vegetables
- Physiological effects:
  - Lowers the oxygen cost of sub-maximal exercise
  - May enhance exercise (6-30 min) performance
  - Reduces resting blood pressure
- The 'dose' of nitrate can be achieved through the consumption of 0.5 L of beetroot juice or an equivalent high-nitrate foodstuff
- It is recommended that nitrate is consumed ~2-3 h prior to competition

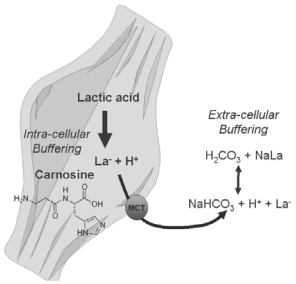
Hoon, M. W. *et al.* Int J Sports Physiol Perform. 2013
Bond, H., Morton, L., Braakhuis, A.J. Int J Sport Nutr Exerc Metab. 2012, 22(4): 251-6

Sources of nitrate

30

Intra- and extracellular buffering

31



32

β- Alanine

meta-analysis 2012

- Intracellular buffering
- Increases muscle carnosine concentration in type I and II muscle fibres
- Delays the onset of fatigue
- Exercises lasting 60-240 s (P = 0.001) and >204 s (P = 0.046) were improved
- The median overall effect was 2.85%
- Best results with 6 g/d for 28 days

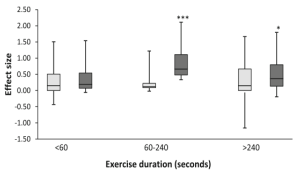


Fig. 2 The effect size of Pla and BA groups when subdivided by exercise duration. *Light grey* represents Pla groups and *dark grey* represents BA groups. * denotes significantly greater than Pla (P = 0.046), *** denotes significantly greater than Pla (P = 0.001)

R.M. Hobson et al. Amino Acids 2012, 43:25-37

Sodium bicarbonate (NaHCO3) and citrate

33

- Extracellular buffering
- Leads to increased plasma bicarbonate and increased buffering
- Improves the rate of H^+ release from active skeletal muscle

⇒Improves intense exercise performance lasting from 1 to 5 min or during repeated sprints

! Can cause significant gastrointestinal upset

- Sodium citrate ingestion is better tolerated but results in lower buffering and performance effects

Hobson, R. M., *et al.* Int J Sport Nutr Exerc Metab. 2013; 23 (5): 480-7
Stellingwerff, T., Maughan, R. J., Burke, L. M. Journal of Sports Sciences, 2011; 29 (S1): S79-S89

Caffeine

34

- Endurance events lasting > 20 min and high intensity sports lasting 1-20 min
- A dose of intake- 3 mg/kg BM
  - Taken an hour prior to exercise
  - Spread throughout exercise
  - Late in exercise as fatigue is beginning to occur
- Reduces the perception of fatigue and allows optimal work outcomes to be maintained for a longer period

! Can cause increases in heart rate, anxiety, impairment of technique etc.

Australian Institute of Sport (www.ausport.gov.au)
Carr, A. J., *et al.* Int J Sport Nutr Exerc Metab. 2011, 21, 357-364

Summary

35

The interactions between training, competition, and nutrition need to be

- approached on an individual basis and
- continuously adjusted and adapted

Free radical reduction, anti-inflammation, health			Macrocycle
Preparatory	Competition	Transition	Mesocycle
Macro-, micronutrient and fluid timing, quality and quantity		Weight management	
CHO types and frequency	CHO emphasis	Energy control	Microcycle
Post-workout nutrition			

The ingestion of beetroot juice, β-alanine, $NaHCO_3$ and/or caffeine may offer a small increase in performance

Thank you!

36

Siret Saarsalu
siret@nutrilligent.ee
+372 5557 4423
www.nutrilligent.ee

NUTRILLIGENT