Nutrition and Hydration for Athletics

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Workshop Content

- The goals of Training Nutrition
- The goals of Competition Nutrition
- Nutritional Supplements
- Ergogenic Aids
- Nutritional Issues and Challenges
- Hydration for Performance
- Practical: Pre and post event sports drinks

Work out your metabolic rate

1) Estimate your basal metabolic rate (BMR)
   Women: BMR = weight in kg x 22
   Men: BMR = weight in kg x 24

2) Work out your physical activity level (PAL)
   Mostly inactive or sedentary (mainly sitting): 1.2
   Fairly active (including walking and exercise 1 – 2 x per week): 1.3
   Moderately active (exercise 2 – 3 x weekly): 1.4
   Active (exercise hard more than 3 x weekly): 1.5
   Very active (exercise hard daily): 1.7

3) Multiply your BMR by your PAL to work out your daily calorie needs
   Daily calorie needs = BMR x PAL

Goals of Training Nutrition

1) Meet the energy and fuel requirement needed to support a training programme
2) Achieve and maintain an ideal physique for the event; manipulate training and nutrition to achieve a level of body mass, body fat and muscle mass that is consistent with good health and performance
3) Enhance adaptations and recovery between training sessions by providing all the nutrients associated with these processes

Goals of Training Nutrition

4. Refuel and rehydrate well during each training session to perform optimally at each session. Practice any intended competition nutrition strategies so that beneficial practices can be identified and fine tuned

   http://www.lucozade.com/sport/sport-science/nutrition-tools/Default.aspx

5. Maintain optimal health and function especially by meeting the increased needs for some nutrients from heavy training

Goals of Training Nutrition

6. Reduce the risk of sickness and injury during heavy training periods by maintaining healthy physique and energy balance and by supplying nutrients believed to assist immune function
7. Make well-considered decisions about the use of supplements and specialised sport foods that have been shown to enhance training or meet training nutrition needs
8. Eat for long term health by paying attention to healthy eating guidelines. Enjoy food and the pleasure of sharing meals

The eatwell plate

Use the eatwell plate to help you get the balance right. It shows how much of what you eat should come from each food group.

Physique – the product of nutrition?

Beijing Marathon Winners

Samuel Wanjiru of Kenya
Constantina Diță-Tomescu of Romania

Beijing 100m Winners

Shelly-Ann Fraser of Jamaica,
Usain Bolt of Jamaica

Goals of Competition Nutrition

- In weight division sports, achieve the competition weight division with minimal harm to health or performance
- Fuel up adequately before an event by consuming carbohydrate and tapering exercise during the days before the event according to the importance and duration of the event
- Top up carbohydrate stores with a preevent meal or snack during the 1 – 4hr before competition

Goals of Competition Nutrition

- Keep hydration at an acceptable level during the event by drinking appropriate amounts of fluids before during and after the event
- Consume carbohydrate during events of >1hr in duration or where body carbohydrate stores become depleted
- Achieve fluid and food intake before and during the event without causing gastrointestinal discomforts or upsets

Goals of Competition Nutrition

- Promote recovery after the event, particularly during multiday competitions such as tournaments and stage races
- During a prolonged competition program, ensure that competition eating does not compromise overall energy and nutrient intake goals
- Make well-considered decisions about the use of supplements and specialised sport foods that have been shown to enhance competition performance or meet competition needs

Nutritional Supplements

Reasons for supplement use

- Most athletes are advised by coaches who have no formal nutritional training
- Popular magazines are the second most common source of information
- ‘Advertorials’ are a major feature of popular magazines
- Athletes do not discriminate between scientific evidence and advertising type
  - Supplement sellers often have very big budgets

What the coaches say

Much of the available information accessed by athletes is doubtful and more often than not simply wrong.

A few treats from the coaches of Olympic athletes:

“There is no evidence at the present time to indicate that athletic performance can be improved by modifying a basically sound diet”

Ha de Vries (1985)

“In Anaerobic exercise the body uses energy about 60% carbohydrates 25% fat acids and 15% protein”

“Calcium gluconate before an event helps, because muscle contractions require calcium ions”

“Salt is not necessary for life”

A Lydiard, G Gilmour (1989)

What the athletes say

"I don't like salad. Burgers are my favourite food."

Matt Le Tissier, England International

"I always had a glass of sherry at half time. It's much better than a cup of tea."

Ron Summers

"My team all drink 6 pints of Guinness the night before a match. The extra iron helps you run faster."

Trevor Lea, footballer

Are supplements the icing on the cake?

Athletes often learn from older and successful performers who succeeded because of **talent**, **genetics**, **training** and **other factors**. They may have been successful in spite of poor dietary habits…….

……. and could have been even better had they taken nutrition seriously.

…….Can icing make up for bad cake?

Types of Supplements

- **Nutritional supplement:**

  Assists the athlete in achieving optimal nutritional requirements

- **Ergogenic aid:**

  Assumed to enhance performance above and beyond that which would normally be expected

Nutritional Agents and Substances

- Carbohydrates (CHO)
- Proteins
- Fats
- Vitamins and Minerals
- Water and special beverages

Nutrient Supplements:

- Sports drinks
- Sports gels
- Sports bars
- Liquid meal supplements
- CHO loaders/high CHO powders
- Iron & Calcium supplements
- Multivitamin/mineral supplements

Nutritional Agents

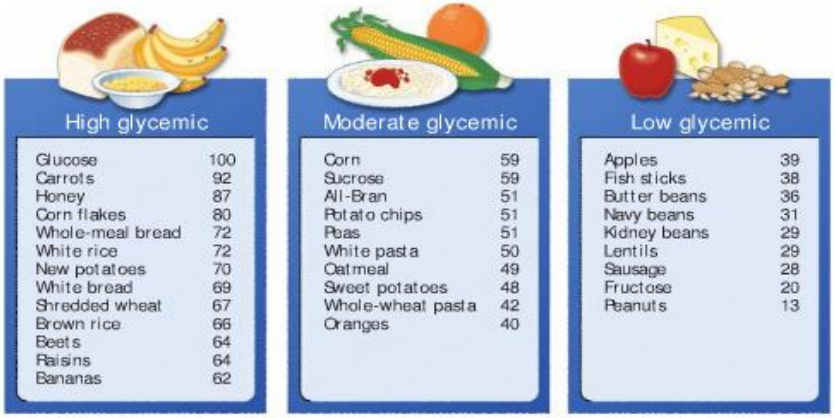
Substance	***EFFECTS***	***PROVEN***	***RISK***
Carbohydrate	Glycogen ⇑ Endurance ⇑	Extensive	Weight gain
Fat	?	Not much data for acute effects	tolerance? cramps
Protein/ Amino acids	Well balanced diet is usually sufficient	In combination with resistance training anabolism increases	Toxicity if in excess/ the evidence is not persuasive though

Carbohydrate

- Consumption in athletes 7-10g/kg/day to meet energy demands, so for a 70kg athlete 490 - 700g of carbohydrate should be consumed

- Consumption recommended before, during and after exercise
  - Pre-exercise meal should contain approximately 1g (e.g.1h pre) to 4.5g (e.g. 4h pre) of CHO/kg (Sherman et al. 1991) 3 -4 hours pre-event
  - Liquid meals can be consumed closer to competition
  - GI should be taken into consideration
    - Low-GI recommended before exercise, moderate to high GI during and following exercise.

High GI or Low GI?



High glycemic	
Glucose	100
Carrots	92
Honey	87
Corn flakes	80
Whole-meal bread	72
White rice	72
New potatoes	70
White bread	69
Shredded wheat	67
Brown rice	66
Beets	64
Raisins	64
Bananas	62

Moderate glycemic	
Corn	59
Sucrose	59
All-Bran	51
Potato chips	51
Peas	51
White pasta	50
Oatmeal	49
Sweet potatoes	48
Whole-wheat pasta	42
Oranges	40

Low glycemic	
Apples	39
Fish sticks	38
Butter beans	36
Navy beans	31
Kidney beans	29
Lentils	29
Sausage	28
Fructose	20
Peanuts	13

High GI Diet	CHO (g)	Contribution to Total GI	Low GI Diet	CHO (g)	Contribution to Total GI
Breakfast			Breakfast		
30 g Corn Flakes	25	9.9	30 g All-Bran	24	4.7
1 banana	30	7.6	1 diced peach	8	1.1
1 slice whole meal bread	12	3.8	1 slice grain bread	14	2.2
1 tsp margarine			1 tsp margarine		
			1 tsp jelly		
Snack			Snack		
1 crumpet	20	6.4	1 slice grain fruit loaf	20	4.1
1 tsp margarine			1 tsp margarine		
Lunch			Lunch		
2 slices whole-meal bread	23.5	7.6	2 slices grain bread	28	4.5
2 tsp margarine			2 tsp margarine		
25 g cheese			25 g cheese		
1 cup diced cantaloupe	8	10.4	1 apple	20	3.6
Snack			Snack		
4 plain sweet biscuits	28	10.4	200 g low-fat fruit yogurt	26	4.1
Dinner			Dinner		
120 g lean steak			120 g lean minced beef		
1 cup of mashed potatoes	32	12.1	1 cup boiled pasta	34	6.4
1/2 cup of carrots	4	1.7	1 cup of tomato and onion sauce	8	2.5
1/2 cup of green beans	2	0.6	Green salad with vinaigrette	1	0.6
50 g broccoli					
Snack			Snack		
290 g watermelon	15	5.1	1 orange	10	2.1
1 cup of reduced-fat milk throughout day	14	1.9	1 cup of reduced-fat milk throughout day	14	1.9
Total	212	69.8	Total	212	39.0

For each diet, the carbohydrate choices are maximized for differences between the two diets.

HIGH GI = 71 – 100
MEDIUM GI = 56 – 70
LOW GI = 0 – 55

The higher the GI, the higher the blood sugar levels after eating that food

Fat reduces the rate at which food is digested, hence why crisps have a lower GI than potatoes but the saturated and trans fats in the crisps can cause heart problems.

Carbohydrate during exercise

- 30-60g (120-240 kcal) of CHO every h to improve performance
  - Consumption of small amounts of CHO every 30-60 min promote hydration, maintain blood glucose levels and prevent gastrointestinal upset.
  - Protein and fat consumed during exercise can delay gastric emptying
  - Solid and liquid forms
    - Drinking 150-300ml of a sport drink (6-8%CHO) every 15-20min can be useful for hydration and energy provision. E.g. hourly drinking of 600ml of a sport drink that contains 6% CHO provides 36g of CHO

Carbohydrate post-exercise

- Delaying CHO intake following intense exercise may reduce muscle glycogen storage and impair recovery
- Athletes should consumed approximately 3g/kg/BW the 2 h period following exercise. e.g. 1.5g immediately post (a sports drink) and the rest 2h post (meal).

Ergogenic Aids

Supplements that have something to offer!

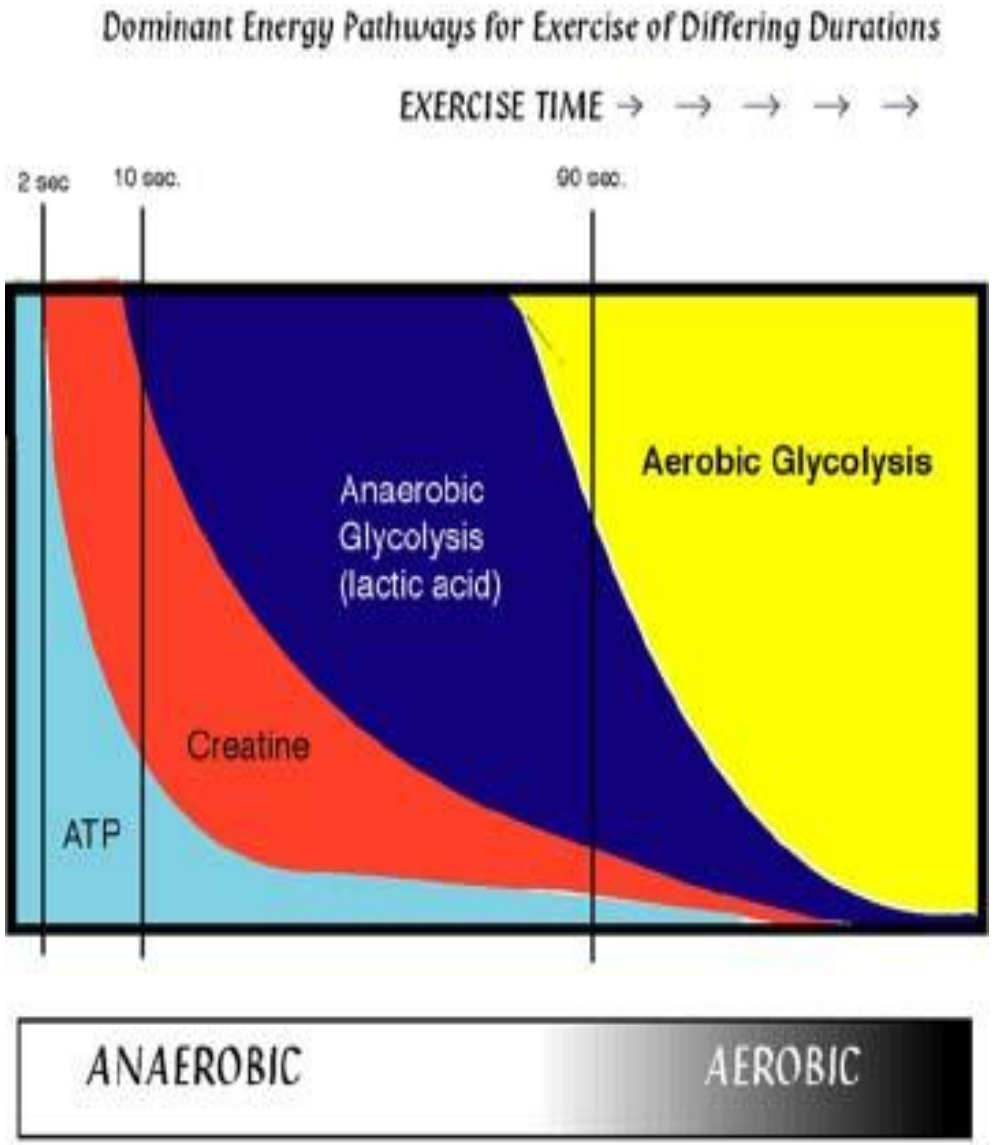
- Caffeine
- Creatine
- Bicarbonate/ Sodium citrate
- Carnosine (β-alanyl-histidine)
- Glycerol

Caffeine

- Early research suggested improved performance was due to stimulation of fatty acid mobilisation ⟶ glycogen sparing
- More recently caffeine has been found to reduce the perception of fatigue by binding to adenosine receptors in the brain (Davies et al, 2003)
- Cox et al (2002) – well-trained cyclists completed a time trial
  - Control participants took 27.05mins
  - Caffeine (90mg) + carbohydrate participants took 26.15mins
- Prior to 2004 caffeine was a controlled substance – threshold level of $12\mu \bullet ml^{-1}$
- Positive effects on performance can be obtained with caffeine doses of $3mg \bullet kg^{-1}$ or less
- Higher doses of caffeine have not been proven to enhance performance any further and it may cause unwanted side-effects, such as insomnia, headaches, nervous disposition, gastrointestinal irritation and bleeding and increased urine flow

Creatine – Rational for Usage

- ATP + Pc:
  - **10 secs of all out work**
- Creatine supplementation increases PCr concentration skeletal muscle by 12-18%.
- This allows for greater ATP availability:
  - Prolongs the use of the energy system
  - Speeds up recovery of PCr pools

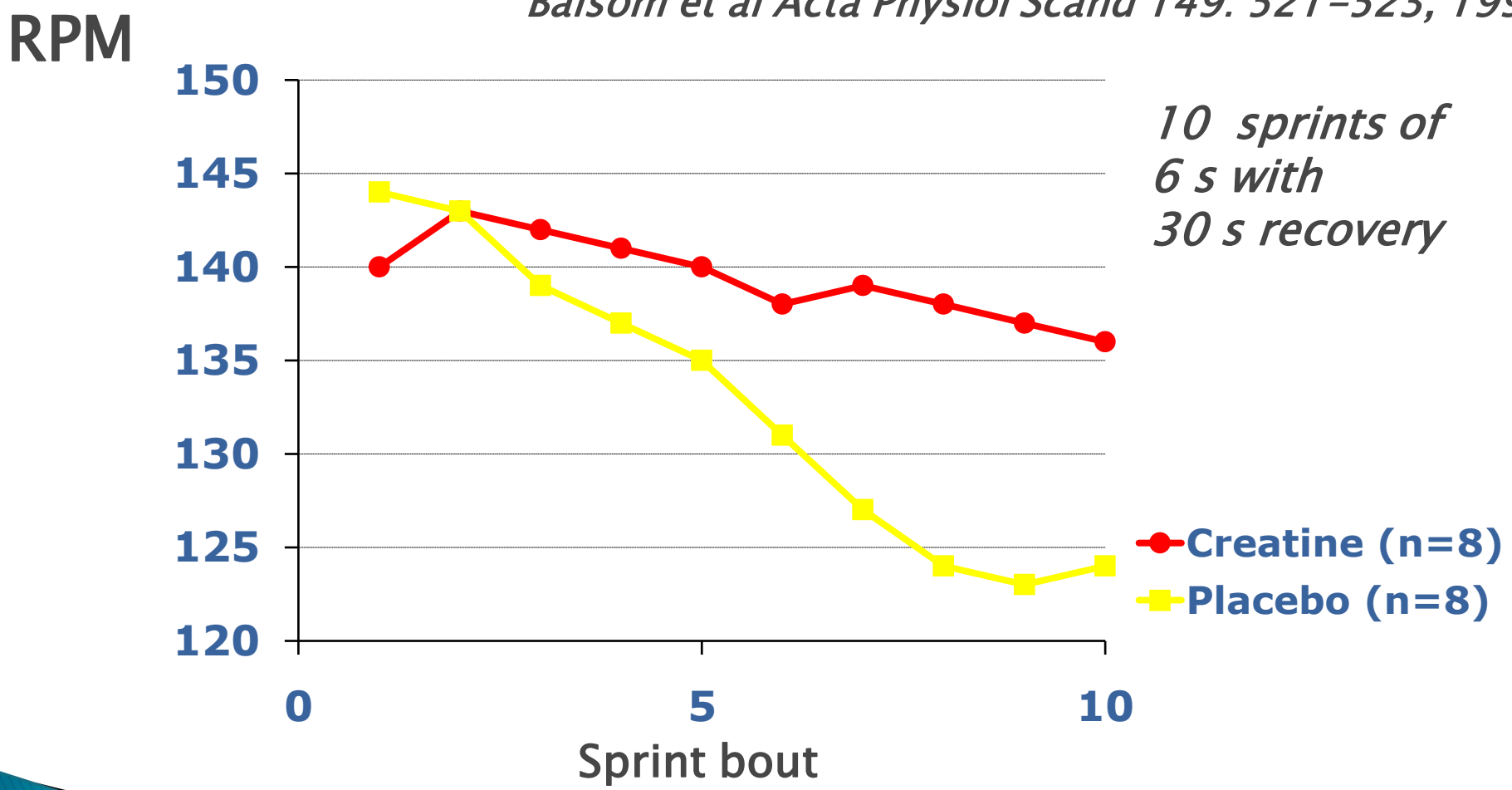


Creatine

- Creatine phosphate is capable of rapid regeneration of ATP within the cell cytoplasm, but limited amount is available
- Substantial evidence to show that creatine supplementation can increase the amounts of creatine and creatine phosphate in the muscles and can improve strength and power events (Hespel, Maughan & Greenhaff, 2006)
- Normal daily intake <1g, but estimated daily requirement is about 2g
- Rest of what we need is synthesised from amino acids supplied by the diet
- **Creatine loading** (Terjung et al, 2000)
  - Loading phase - 20g/day in 4 divided doses of 5g for 4 – 6 days
  - Maintenance – 2-5g/day
- Creatine + Carbohydrate supplementation has been shown to increase creatine storage by elevating circulating insulin concentraions

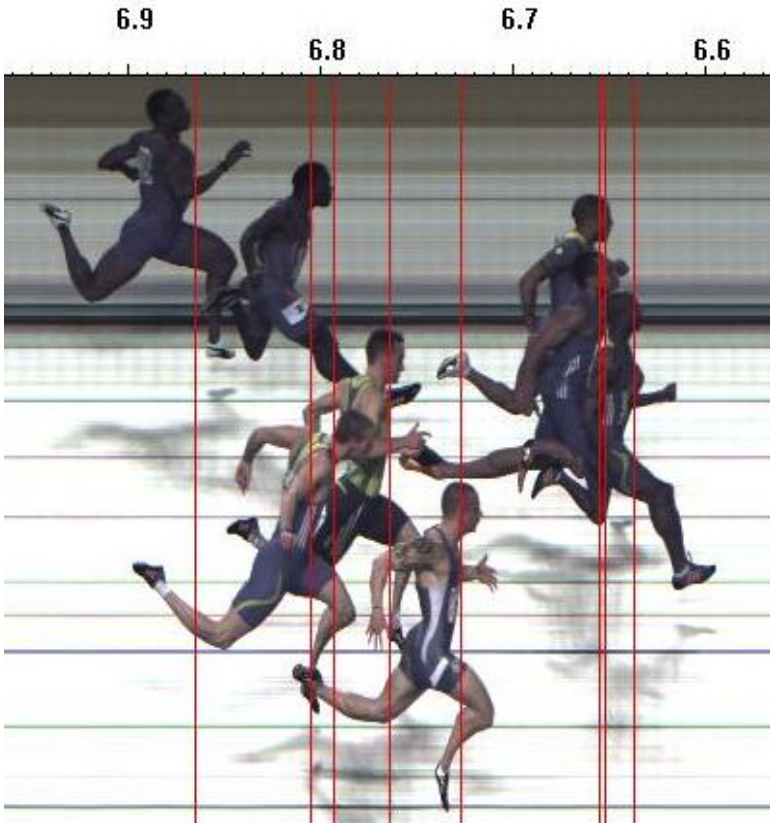
Creatine and sprint performance

Balsom et al Acta Physiol Scand 149: 521-523, 1993



Bicarbonate – middle distance

- Anti-acid for the muscle
- To maximise energy supply by anaerobic glycolysis, local buffering agents within the cell remove the hydrogen ions
- Increasing buffering capacity should increase performance where acidity is a limiting factor
- 3 second improvement in 800m race time with 0.3g/kg sodium bicarbonate
- Typical dose – 300 – 500mg/kg taken 1 – 2 hour pre-event
- Chronic loading protocol: 500mg/kg/day for 5 days



BUT – Sodium bicarbonate can produce severe flatulence!

Supplements that may have something to offer…

- Arginine/glutamine
- Echinacea
- Glucosamine
- Zinc
- Antioxidants

NO SCIENTIFIC SUPPORT FOR THE REST OF THE SUPPLEMENTS!!!!

Issues associated with supplement use

1) Efficacy – does it work?
   - If so, under what conditions?
     - During competition?
     - Weightlifting? Football
2) Safety – are there any possible adverse effects?
3) Ethics – is its use in sport legitimate?

How strong does the evidence have to be
- for the positive effect on performance
- for safety (performance and health)
- for compliance with doping regulations

BUT – If you wait until you are sure it is ok to use, others may already be using them and have gained an advantage

Supplements or food?

- In only a few situations supplementation may be warranted
  - Iron supplementation as a short term solution when deficiency is demonstrated
  - Low dose supplementation when food choices are poor or when food intake is restricted

Supplements & Ergogenic Aids

‘ sportsmen and women are always looking for that something that will provide them with a competitive advantage…….’

Get the diet right…..!!

Contamination

- Some nutritional supplements have been found contaminated with illegal substances (Maughan, 2004; Maughan et al., 2004; Striegel et al., 2005)
- Lead, broken glass, animal faeces
- Gastrointestinal problems (microbial contamination)
- Failed drugs test?

Contamination–IOC accredited lab study (2000)

Geyer, et al (2000)

Between Oct 2000–November 2001

634 non-hormonal supplements from 13 countries from 215 suppliers

578 from shops, 52 by internet 2 by telephone and 2 sent by IOC

289 supplements were from prohormone-selling companies and 345 from companies which did not offer prohormones

Contamination–IOC accredited lab study (2000)

Findings:

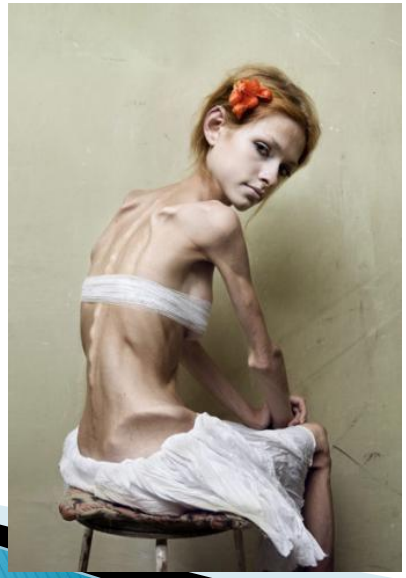
- 11 anabolic androgenic steroids
- 94 (14.8%) contained prohormones not declared on the label.
- No reliable data from 66 samples

http://www.publications.parliament.uk/pa/cm200607/cmselect/cmsctech/67/67we18.htm

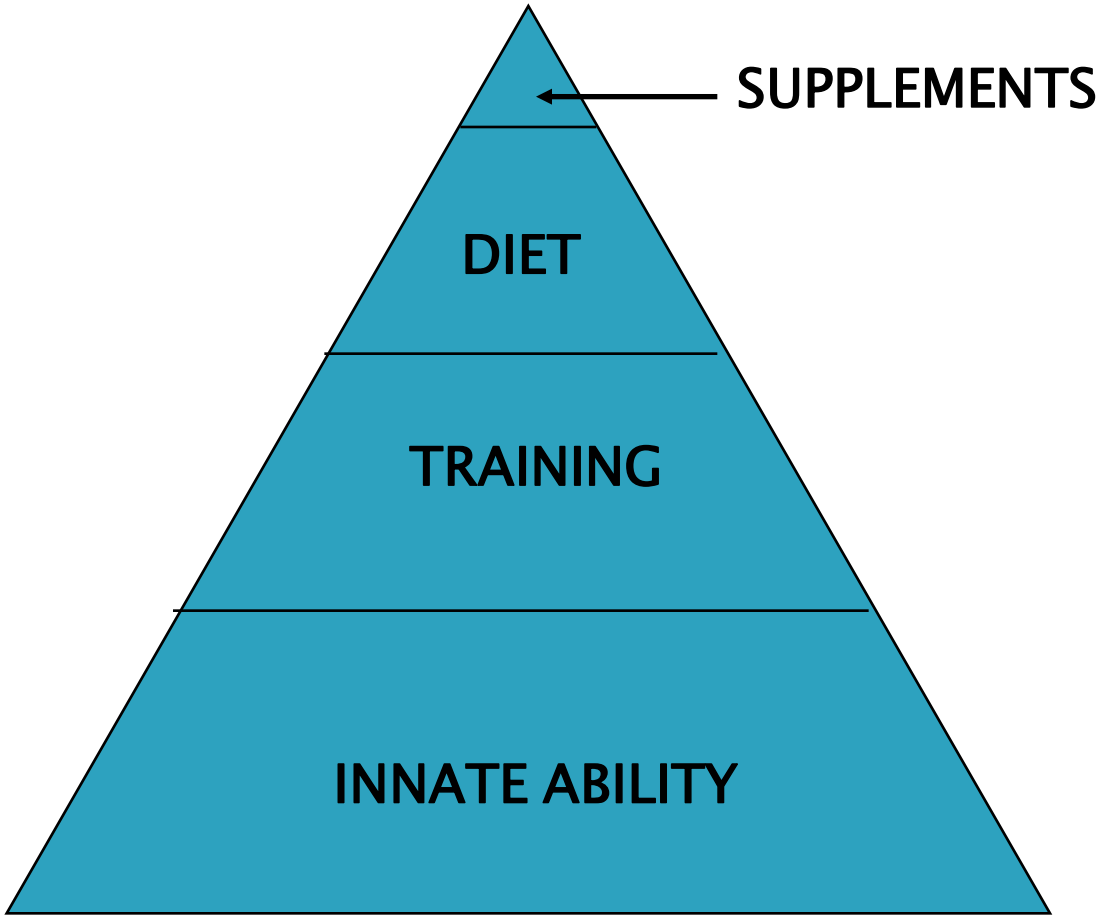
www.consumerlab.com

Nutritional Challenges in Athletics

- Cultural factors (e.g. Ramadam)
- Young athletes (growing = extra protein?)
- Vegetarians/Vegans
- Energy restriction and disordered eating
- Gastrointestinal problems



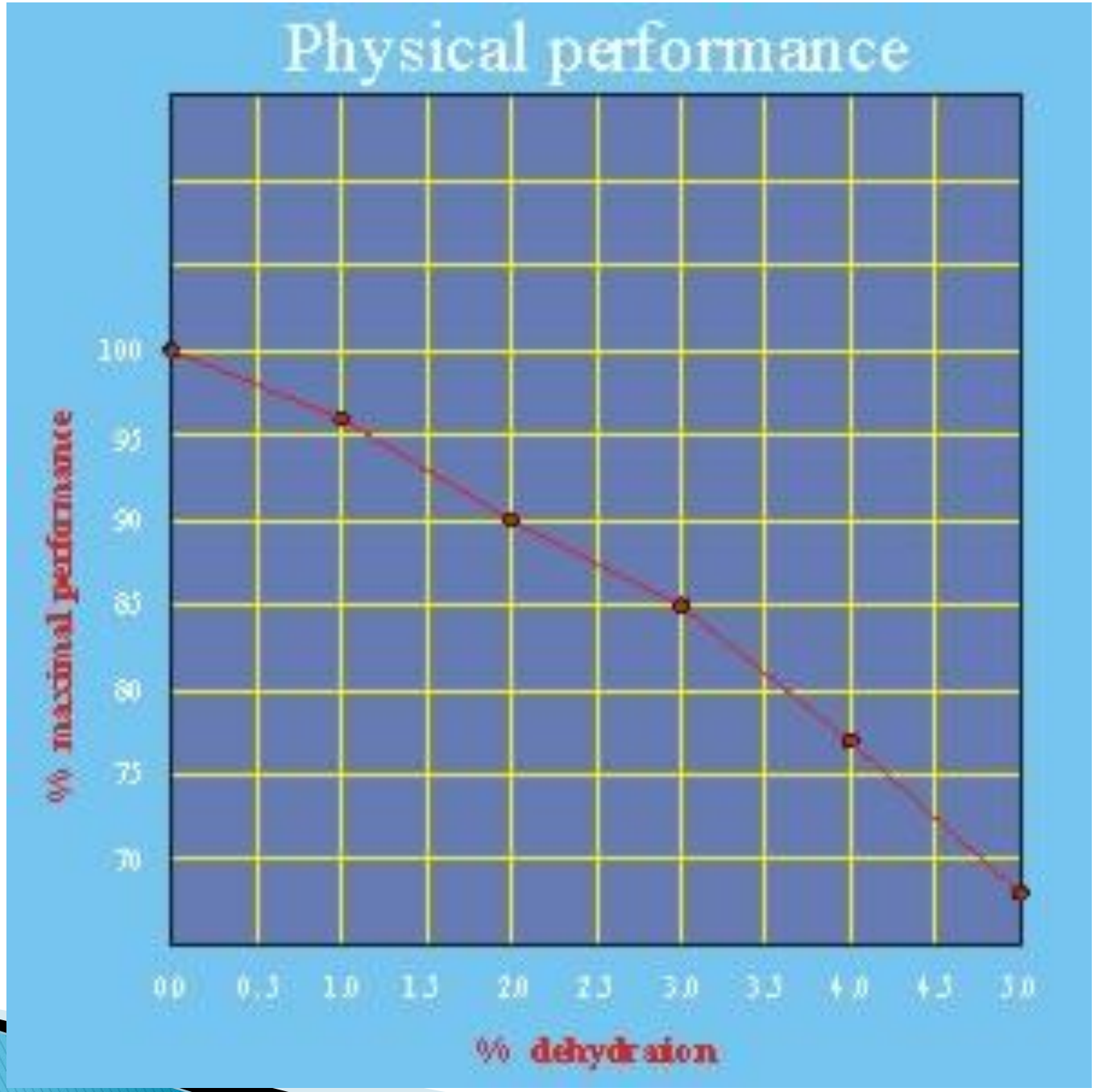
Keeping it in perspective



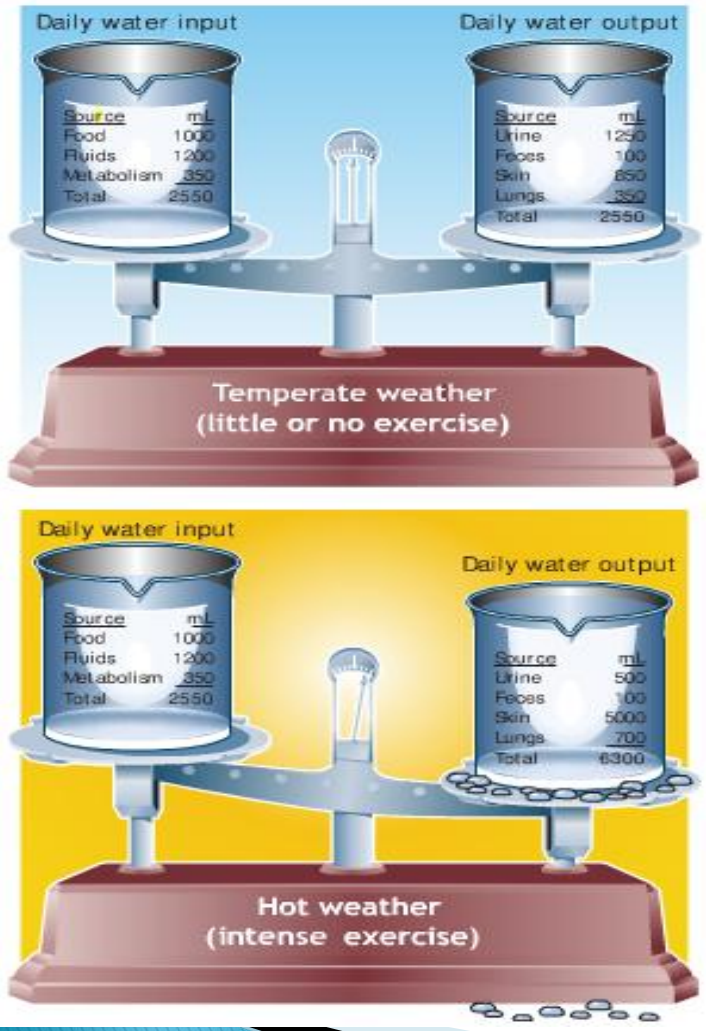
Hydration for Performance

Effects of Dehydration

- A weight loss of 2% from sweating will affect the ability to exercise and your VO_2 max will fall by 10 – 20%
- 4% = nausea, vomiting and diarrhoea
- 5% = 30% decrease in VO_2 max
- 8% = dizziness, laboured breathing, weakness and confusion
- >8% = circulatory collapse, heat stroke


Physical performance
100
95
90
85
80
75
70
% maximal performance
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
% dehydration

Dehydration from exercise



- Sedentary adult, thermoneutral environment requires 2.5L water/day
- Active person, warm, humid environment requires 5-10L water/day

Reduction in blood volume, reduces body fluid so reduces circulatory flow to skin for cooling.
Dehydration reduces the performance of prolonged exercise:

1) ⬆ Cardiovascular stress
2) ⬆ Perception of effort
3) ⬆ Risk of impaired gastrointestinal function and discomfort
4) ⬇ Concentration and mental function

Hydration techniques

- Drink 400 – 600 mL of fluid 2 to 3 hours before exercise
- Drink 150 – 300 mL of fluid about 30 mins before exercise
- Drink no more than 1000mL per hour of plain water spread over 15 min intervals during or after exercise
- Add a small amount of salt (1/4 to ½ teaspoon) to all ingested fluid
- Do not restrict salt in diet
- Include some glucose in the rehydration drink to facilitate intestinal water

BUT – Be careful not to excessively consume fluid as this could lead to hyponatraemia

Practical

HYPOTONIC

1) 20–40g glucose
   1L warm water
   1 – 1.5g salt
   Sugar free low cal squash
2) 250ml fruit juice
   750ml water
   1 – 1.5g salt

ISOTONIC

1) 40 – 80g glucose
   1L warm water
   1 – 1.5g salt
   Sugar free low cal squash
2) 500ml fruit juice
   500ml water
   1 – 1.5g salt

Hypotonic = lower osmolality than bodily fluids. Dilute CHO electrolyte solutions, less concentrated than bodily fluids so rapidly absorbed

Isotonic = same osmolality as bodily fluids. Similar CHO electrolyte solution to bodily fluids so promote slower absorption but with the benefit of boosting energy intake

Take home message

- For any athlete it is important to ensure they are having a daily balanced diet and are adequately hydrated
- Very few supplements are of any use and they are often expensive… But you could make your own sports drinks
- Before taking any supplements/aids check on the WADA banned substances list or consult a sports nutritionist/dietician
- Enjoy your food!

Useful links

- http://www.nhs.uk/Tools/Pages/HealthyEating.aspx – this provides lots of information on what to eat to have a healthy balanced diet and there are also tools which can test your diet and provide informative feedback
- www.foodafactoflife.org.uk – this provides a progressive approach to teaching about healthy eating , cooking, food and farming from 3 – 16 years
- www.nutrition.org.uk – lots of healthy eating tips and all of the latest research about a balanced diet
- http://www.wada-ama.org/ – provides information on all banned substances. You can even get an app for this on you i-phone now, so no excuses!

Thank you

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