Getting Active with DAFNE

Anita Beckwith

Sarah Donald

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Aims of session

- Changes to curriculum
- Problems encountered when delivering this session
- Recap on principles of exercise
- Practise with case scenarios

Changes to the curriculum

- Understand benefits of physical activity
- Be aware of situations during extended periods of exercise (> 1hr) where they can “top up” with carbohydrates during the exercise.
- Understand the importance of maintaining good hydration status before, during and after exercise

What we need to tell patients

- Why exercise is important in diabetes
- When and why blood glucose levels can decrease, increase or remain the same after exercise
- What to do about it

Fuelling exercise

- 3 energy systems:
  - ATP-phoshocreatinine system
  - Glycolytic system
  - Oxidative system

Exercise begins

Increased adrenaline, growth hormone,glucagon
Decreased insulin

Increased fuel demands

Increased O_2 demands

Increased cardiac output, Increased respiration

ATP and phosphocreatinine in muscle used in 1st 3 to 15 s

Fast glycolysis provides energy from glycogen in muscle and **glucose** from blood, this diminishes after 45s

Slow glycolysis, Krebs cycle etc using both fat and **glucose**

Types of exercise

- Activities of Daily Living
- Short/sharp, stop/start
- Endurance
- Extreme

Activities of daily living

- Housework
- Gardening
- Shopping
- Travel to work

Short/start, stop/start

- Weight lifting
- Body Building
- Dressage
- Fencing
- Track and field events (Javelin, Shot put, Long jump, Pole-vault, High jump, Sprinting)
- Archery
- Gymnastics (Bars, Beam, Floor, Rings, Horse, Vault)
- Martial Arts (Variable Durations and Intensity)
- Indoor Racket Sports (Squash)
- Wrestling
- Power Movements in Endurance Power Sports

Endurance

- Hiking
- Golf
- Road cycling
- Mountain biking
- Running
- Swimming
- Triathlon

Energy systems used in sport

Sport	ATP-PCr & Glycolysis	Glycolysis & Oxidative	Oxidative
Basketball	60	20	20
Fencing	90	10	0
Field Events	90	10	0
Golf swing	95	5	0
Gymnastics	80	15	5
Hockey	50	20	30
Rowing	20	30	50
Running (distance)	10	20	70
Skiing	33	33	33
Soccer	50	20	30
Swimming (distance)	10	20	70
Swimming (50m freestyle)*	40	55	5
Tennis	70	20	10
Volleyball	80	5	15

Taken from Foss ML and Keteyian S. (1998) *The Physiological Basis of Exercise & Sport: 6th Edition.*

Dictated by intensity and duration of sport

Intensity	Fuel used	Main Source
Low 40 – 60% Max heart rate	Free Fatty Acids	Fat
Moderate 60 – 75% Max heart rate	Free Fatty Acids & Glucose	Fat, Muscle and Liver Glycogen and CPs
High 75 - 90% Max heart rate	Glucose	Muscle and Liver Glycogen and CHO

* Max Heart rate = 220 - age

Effects of insulin

Circulating Insulin levels	Fuel provision via Liver	Muscle uptake of glucose	Blood Glucose Levels
High	Decreased	Increased	Hypo
Low	Increased	Decreased	Hyper
Appropriate	Increased	Increased	Stable

Why blood glucose is upset in diabetes

Hypoglycaemia occurs:

- If blood insulin levels are high
  - Exercise soon after meal bolus
  - Inject or infuse into exercising limb (↑ insulin absorption)
- If exercise is prolonged, e.g. marathon (glucose utilised by muscles)
- When there is delayed hypoglycaemia (e.g. next day) – muscle insulin sensitivity and glucose uptake ↑ to replace muscle glycogen stores

Strategies for avoiding hypoglycaemia

- Consume extra CHO
- Reduce insulin
- Both

Extra CHO to prevent hypo

- 30-60 g for each hour
  - 30 g before and 30 g at each 30 min point
  - Test BG before after and check for late hypo

- 1 g/kg body wt per hour (based on rate of glucose uptake by muscle in exercise)

- Tables and charts which relate type of sport, body weight to CHO per hour (for regular sports)

Why blood glucose is upset in diabetes

Hyperglycaemia occurs:

- If blood insulin level or activity low
  - Exercise long after insulin bolus (e.g. pre-breakfast or late afternoon)
  - Stress hormones released by exercise, antagonize insulin action
  - Can be a risk of ketoacidosis

Exercise protocols must be individualized with BG monitoring

- Exercise responses depend on:
  - Type of exercise
  - Intensity
  - Timing in relation to meals/insulin bolus
  - Duration
  - Fitness of individual
  - Insulin sensitivity of individual
  - Metabolic control at start of exercise

Case study: Mike

- 32 year old male
- Unemployed (chosen to be able to concentrate on his health)
- Severe back pain – alleviated by regular exercise and pain relief
- Daily activity- varies between spinning, yoga and weights
- Has always found BGs difficult to mange
- Attended DAFNE 4 years ago, lost to follow up, returned for advice, motivated to improve.

DATE	Time	10.00	11.30	14.00	18.00	22.00	22.15	00.00	02.00		Comments
1	CP	4		4	5	3	7		3		Spinning 19.30-20.30
	BG	18.0	14.3	17.4	11.7	3.1	1.9	18.0	15.1		
	QA	8+7		6+10	10			8+7	5		
	BI	20					20				
DATE	Time	10.00	11.15	12.30	14.30	16.30	17.00	19.00	21.00	00.00	
2	CP	8		+4			4+5	7			Spinning 19.30-20.15
	BG	6.1	13.2	3.2	2.3	8.8	2.1	18.0	5.1	13.2	
	QA	16	+5					14		+4	
	BI	20							20		
DATE	Time	10.00	14.00	16.00	19.30	23.30	02.00	03.00			
3	CP	3	7	7	8						Weights 21.00-22.30
	BG	18.0	2.5	25.2	5.5	22.3	19.9	17.6			
	QA	6+5		14+10	16	+15	+5				
	BI	20				20					

Case study: Kimberley

- 23 year old female
- BMI= 32- keen to exercise to lose weight
- New exercise regimen (previously quite sedentary)
- Resistance training/stop start activity: circuits
- 6 month DAFNE follow up
- Losing motivation to exercise as cannot understand swinging BGs

DATE	Time	09.00	11.30	17.00	20.30	23.00	01.00	Comments
1	CP	+4	6	8		2		20.30 (60 mins) circuits/British
	BG	2.1	12.3	18.2	9.1	13.5	12.2	
	QA		6	8+4		2	+2	
	BI		12			12		
DATE	Time	09.00	11.00	15.00	16.00	20.00	23.00	
2	CP	2	5		7	5	4	18.00: running 45 mins
	BG	3.1	11.5	10.2	9.4	4.8	14.4	
	QA		5		7		4+4	
	BI		12				12	
DATE	Time	10.00	12.30	16.00	18.00	23.00	04.00	
3	CP	3	5		7+3		6	21.30 (60 mins) circuits/British military fitness
	BG	3.1	11.5	9.4	4.8	14.4	2.1	
	QA		5+2		7			
	BI		12			12		