

Diabetes



Unit: Understanding medical conditions for exercise referral

Diabetes (diabetes mellitus)

- Pancreas does not produce enough insulin, or
- Body cannot effectively use the insulin it produces
- Hyperglycaemia (raised blood sugar) is a common effect of uncontrolled diabetes
- Over time leads to serious damage to many of the body's systems
 - Micro vascular
 - Macro vascular
- Reduced life expectancy & morbidity due to specific diabetes-related medical complications

Complications

Micro vascular

- Peripheral neuropathy
- Autonomic neuropathy
- Retinopathy
- Nephropathy

Macro vascular

- Ischaemic heart disease
- Stroke
- Peripheral vascular disease

Classification

Diabetes covers a range of blood glucose disorders and falls into four main categories:

- Type 1 diabetes mellitus
- Type 2 diabetes mellitus
- Secondary diabetes mellitus
- Gestational diabetes mellitus



What do you know about each of these types of diabetes?

Diagnosis

- At least two different blood glucose tests are taken at different times, as well as an investigation into associated symptoms.
- Most commonly tests:
 - fasting plasma glucose (FPG)
 - oral glucose tolerance test (OGTT)

Prevalence

- Rising at younger ages especially in men.
 - Numbers of people in UK with condition risen from 1.4 (1996) to 2.9 million (2012).
 - Projections estimate that 5 million people will have diabetes by 2025 (most will be type 2).
- UK prevalence:
 - England - 5.5%.
 - Wales – 5.0%.
 - Northern Ireland – 3.8%.
 - Scotland – 4.3% .

Cost to the nation

- Cost to the NHS was £9.8 billion in 2010/11:
 - £1 billion for type 1 and £8.8 billion for type 2.
 - 80% of the costs are spent on complications, rather than treatment of the condition itself.
 - Costs equate to 10% of the NHS budget.
 - Projections suggest that by 2030 costs will account for 17% NHS budget.
- Total UK cost in 2010/11 = £23.7 billion
 - Projections suggest that total costs will rise to £39.8 billion by 2035/6.



Pathology

- Hyperglycaemia and diabetes caused by:
 - Insufficient production of insulin
 - Inability of cells to use insulin properly and efficiently
- Ineffective use of insulin
 - affects mostly the cells of muscle and fat tissues
 - results in a condition known as "insulin resistance."
 - primary problem in type 2 diabetes.
- Absolute lack of insulin
 - usually secondary to a destructive process affecting the insulin producing beta cells in the pancreas
 - main disorder in type 1 diabetes

Presentation

- Classic symptoms are:
 - polyuria (frequent urination)
 - polydipsia (increased thirst)
 - polyphagia (increased hunger)
- Symptoms may develop
 - type 1 - rapidly (weeks or months)
 - type 2 - develop more slowly, may be subtle or absent
- Diabetic ketoacidosis (metabolic dysregulation) characterized by:
 - the smell of acetone
 - rapid deep breathing
 - vomiting, abdominal pain
 - altered states of consciousness

Risk factors

- Type 1 still being researched
 - Genetic factors - having a family member with type 1 diabetes
 - Environmental factors - increased height and weight development, increased maternal age at delivery, exposure to some viral infections
- Risk factors associated with type 2, include:
 - obesity
 - diet and physical inactivity
 - increasing age
 - insulin resistance
 - family history of diabetes
 - ethnicity



Part two

ACCEPTED TREATMENTS

Common medications

- **Type 1 diabetes**

- Insulin.
- Administered directly into the blood stream by injection.
- Injected into the upper arm, abdomen, thigh or buttocks.

- **Type 2 diabetes**

- Metformin & sulphonylureas
- To assist in the management of blood glucose



Credible sources:

- *British National Formulary (BNF)*

- *MIMs*

- *Patient UK*

- *NICE*

Side effects may include

- **Insulin**
 - Hypoglycaemia
- **Metformin**
 - Initial GI discomfort, nausea, vomiting, and diarrhoea
 - gradual increase in dose should minimise these effects.
- **Sulphonylureas**
 - Hypoglycaemia (due to over stimulation of insulin)



Any implications for exercise?

Medication and exercise

- Most significant effect is hypoglycaemia
- During and after exercise
- Attention to:
 - timing of medication
 - food intake & blood glucose before and after exercise
- Blood glucose should be checked periodically during exercise of long duration (i.e. greater than 60 minutes).

Lifestyle intervention

Individual care plan for Type 1:

- diabetes education, including lifestyle and nutritional advice
- insulin therapy
- self-monitoring
- arterial risk factor surveillance and management
- late complications surveillance and management

Lifestyle intervention

Individual care plan for Type 2:

- Lifestyle and activity adjustments
- Treated with metformin and monitored for effectiveness
- If HbA_{1C} remains >6.5% then sulphonylurea is added to the treatment plan
- Monitored for drug efficacy and any signs of deterioration
- If HbA_{1C} remains >7.5% then thiazolidinedione or insulin is added to the treatment plan
- If problems persist, then the insulin is used preferentially with metformin and sulphonylurea, and dosage monitored and increased as necessary



Part three

EXERCISE GUIDELINES AND CONSIDERATIONS

Rationale for exercise

The benefits of aerobic exercise for type 2 diabetes include:

- increases in both insulin sensitivity and non-insulin dependent muscle glucose uptake
- increases in muscle concentration of GLUT 4 transporter proteins that draw glucose into muscle cells
- increased oxidation rates of muscle glucose
- increased insulin sensitivity and glucose uptake persist long after aerobic exercise
- increased intramuscular lipid accumulation to help fuel aerobically trained muscle tissue
- increased insulin sensitivity after a single bout of exercise may last between 24-72 hours, dependent on intensity and duration

Exercise considerations

Adults with diabetes should be offered information about:

- appropriate intensity and frequency of physical activity
- role of self-monitoring of changed insulin and/or nutritional needs
- effect of activity on blood glucose levels (a fall is likely) when insulin levels are adequate
- effect of exercise on blood glucose levels when hyperglycaemic and hypoinsulinaemic (risk of worsening of hyperglycaemia and ketonaemia)
- appropriate adjustments of insulin dosage and/or nutritional intake for exercise and post-exercise periods, and the next 24 hours
- interactions of exercise and alcohol

Exercise recommendations

Mode of exercise	FIT principles
Aerobic	<ul style="list-style-type: none"> • 50%-80% maximum heart rate/VO_{2max} • Monitor RPE and HR during exercise • 20-60mins per session • 4-7 sessions per week
Resistance	<ul style="list-style-type: none"> • Low resistance, high reps for most clients • High resistance OK for clients with well controlled diabetes • 20-60 mins per session • 1-3 days/week
Flexibility	<ul style="list-style-type: none"> • Static stretches hold for 10-30 secs • Active/dynamic stretching also OK, providing no limitations in mobility • 2-3 sessions per week may suffice
Neuromuscular	Daily

Other considerations

- Managing hypoglycaemia
- Additional exercise precautions
 - Injection sites
- Exercise contraindications (Durstine et al., 2009):
 - active retinal haemorrhage, or the client has recently received laser therapy for retinopathy
 - illness or infection
 - blood glucose above 13.8mmol/L and ketones (hyperglycaemia)
 - blood glucose less than 3.9mmol/L

Comorbidities

- Consider
 - Any change in risk stratification?
 - Effects of medications
 - Exercise recommendations for other conditions
 - Further adaptations and modifications?