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DOCUMENT TITLE

HUMAN PERFORMANCE AND LIMITATIONS

CHAPTER 3 – DIABETES

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DIABETES

3.1 Introduction

Doctors have warned that the world is experiencing a diabetes epidemic, a sign that something in our way of life has gone wrong. Diabetes is a major cause of heart disease and death. It is the leading cause of blindness and kidney damage, and the most common cause of amputation. The developed world also bears the lion's share of cancer cases, but less developed areas are quickly catching up. Worldwide, lung cancer is the most common and deadliest cancer.

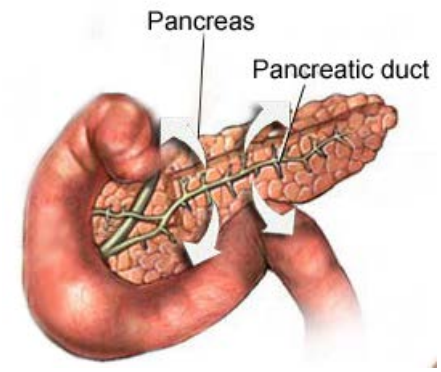
Illnesses such as diabetes and cancer may have a serious impact on the life and career of aviation personnel. Medical certification in both cases may be conditional and/or very restrictive.

3.2 Diabetes Mellitus

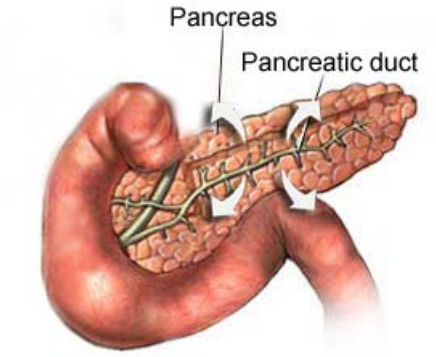
Diabetes is a life-long disease marked by high levels of sugar in the blood. It may be caused by too little insulin (i.e. a hormone produced by the pancreas to regulate blood sugar), resistance to insulin or both.

To understand diabetes, it is important to first understand the normal process of food metabolism. Several things happen when food is digested:

- A sugar called glucose enters the bloodstream. Glucose is a source of fuel for the body.
- An organ called the pancreas makes insulin. The role of insulin is to move glucose from the bloodstream into muscle, fat and liver cells, where it can be used as fuel.



Normal insulin production

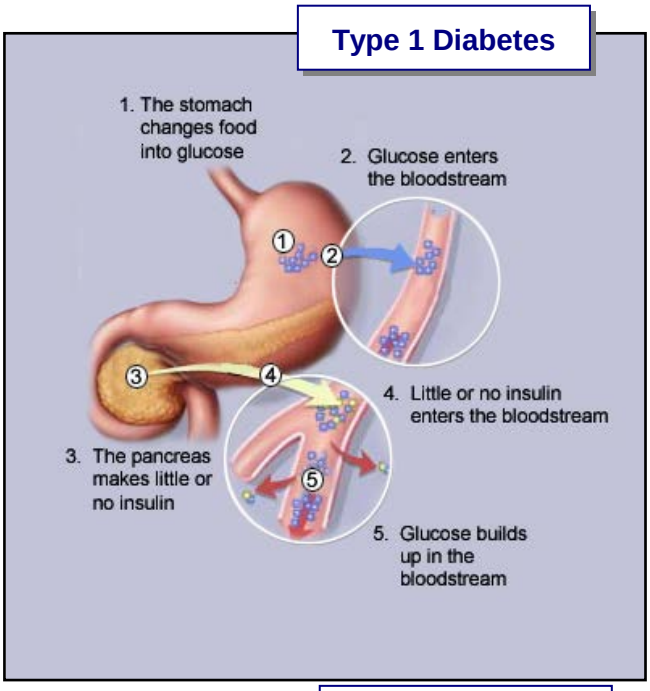


People with diabetes have high blood glucose. This is because their pancreas does not make enough insulin or their muscle, fat and liver cells do not respond to insulin normally, or both.

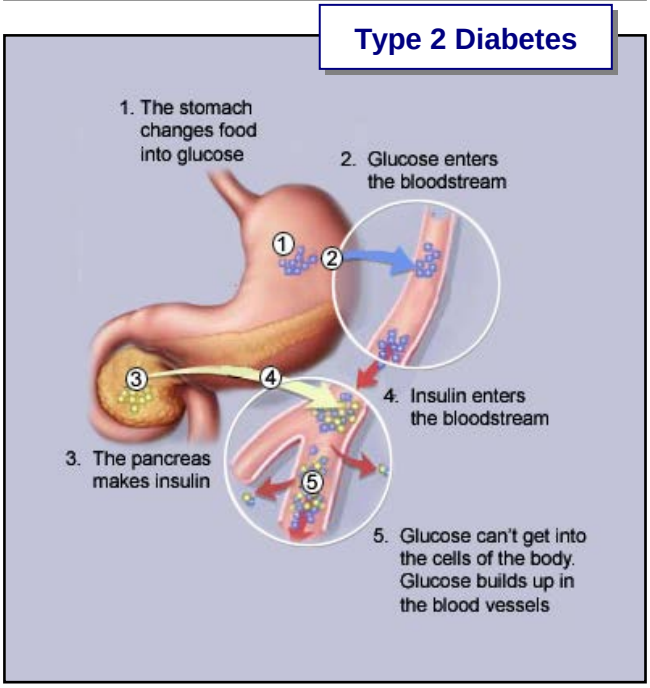
Insufficient insulin production (diabetes mellitus)

There are three major types of diabetes:

- **Type 1 Diabetes** is usually diagnosed in childhood. The body makes little or no insulin and daily injections of insulin are required to sustain life. Without proper daily management, medical emergencies can arise.



- **Type 2 Diabetes** is far more common than Type 1 and makes up 90% or more of all cases of diabetes. It usually occurs in adulthood. Here, the pancreas does not make enough insulin to keep blood glucose levels normal, often because the body does not respond well to the insulin. Many people with Type 2 diabetes do not know they have it, although it is a serious condition. Type 2diabetes is becoming more common



due to the growing number of older people, increasing obesity and failure to exercise.

- **Gestational diabetes** is high blood glucose that develops at any time during pregnancy in a person who does not have diabetes.

Gestational Diabetes

There are many risk factors for diabetes, including:

- A parent, brother or sister with diabetes
- Obesity
- Older than 45 years
- Some ethnic groups
- Gestational diabetes or delivering a baby weighing more than 9 pounds
- High blood pressure
- High blood levels of triglycerides (a type of fat molecule)
- High blood cholesterol level.

It is recommended that all adults be screened for diabetes at least every three years. A person at high risk should be screened more often. High blood levels of glucose can cause several problems, including frequent urination, excessive thirst, hunger, fatigue, weight loss, and blurry vision. However, because Type 2 diabetes develops slowly, some people with high blood sugar experience no symptoms at all.

Symptoms of Type 1 Diabetes:	Symptoms of Type 2 Diabetes:
• Increased thirst • Increased urination • Weight loss in spite of increased appetite • Fatigue • Nausea • Vomiting.	• Increased thirst • Increased urination • Increased appetite • Fatigue • Blurred vision • Slow-healing infections • Impotence in men.

Patients with **Type 1 diabetes** usually develop symptoms over a short period of time and the condition is often diagnosed in an emergency setting. In addition to having high glucose levels, acutely ill Type 1 diabetics have high levels of ketones. Ketones are produced by the breakdown of fat and muscle, and they are toxic at high levels. Ketones in the blood cause a condition called "acidosis" (low blood pH). Urine testing detects both glucose and ketones in the urine.

There is no cure for diabetes. The immediate goals are to stabilise the blood sugar and eliminate the symptoms of high blood sugar. The long-term goals of treatment are to prolong life, relieve symptoms and prevent long-term complications such as heart disease and kidney failure.

Unlike Type 1 diabetes, **Type 2 diabetes** may respond to treatment with exercise, diet and/or oral medications.

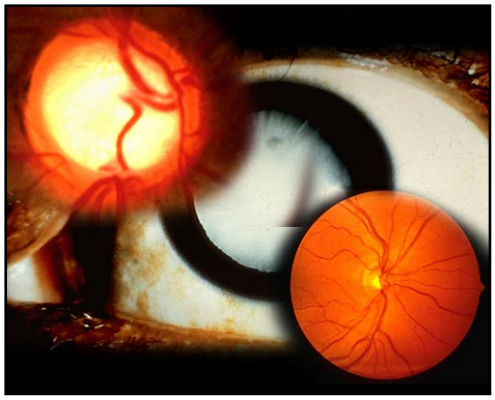
Gestational diabetes is treated with diet and insulin.

Regular exercise is especially important for people with diabetes. It helps with blood sugar control, weight loss, and high blood pressure.

People with diabetes who exercise are less likely to experience a heart attack or stroke than diabetics who do not exercise regularly.

People with diabetes are prone to foot problems because of the likelihood of damage to blood vessels and nerves and a decreased ability to fight infection. Problems with blood flow and damage to nerves may cause an injury to the foot to go unnoticed until infection develops.

Death of skin and other tissue can occur. If left untreated, the affected foot may need to be amputated. Diabetes is the most common condition leading to amputations.



The eyes can be affected in several ways by diabetes mellitus. Diabetic retinopathy is one of the leading causes for irreversible blindness. This retinopathy can occur with either Type 1 or Type 2 diabetes mellitus, usually a decade or so after the onset of diabetes.

Most persons with Type 1 diabetes and many of those with Type 2 diabetes develop some background (non-proliferative) retinopathy.

Proliferative retinopathy is more ominous and is more likely to occur when diabetes mellitus is poorly controlled.

In severe retinopathy, neovascularisation may lead to adhesions (synechiae) between iris and cornea or iris and lens. Neovascularisation of the iris leads to secondary glaucoma with blindness.

Cataracts are also more common in diabetics. This predilection for development of cataracts is felt to result from hyperglycaemia leading to accumulation of sorbitol, which results in osmotic damage to the crystalline lens.

3.3 Aviation and Diabetes

On diagnosis, inform CASA Aviation Medicine Section and advise applicant not to exercise the privileges of his/her licence until cleared to do so by CASA.

Requirements for medical (re-)certification are set out in the following paragraphs:

1. Persons with diabetes mellitus controlled by diet may receive medical certification at Class 1, 2 or 3 provided they meet the following criteria:
    - Evidence of stable blood glucose control:
        - Glycosolated Haemoglobin (HbA1c) taken within one month of assessment <7.5%.
        - Satisfactory reports as detailed by CASA.
    - Absence of complications that could result in sudden or subtle incapacitation when exercising the privileges of a licence.
2. Persons with diabetes mellitus controlled by diet and oral hypoglycaemic drug(s) may receive unlimited medical certification at Class 2 or 3 levels only. Such persons who seek Class 1 (re-)certification may be offered (re-) certification with an 'as or with copilot' restriction. Prior to their (re-)certification, CASA requires objective evidence that these applicants meet the following criteria:
    - No unacceptable side effects from drugs
    - Evidence of stable blood glucose control
        - No episode of symptomatic hypoglycaemia during the preceding 12 months
        - Glycosolated Haemoglobin (HbA1c), taken within preceding month <7.5%
        - Satisfactory reports as detailed in the previous section, Other Investigations.
    - Absence of neurological, cardiovascular, ophthalmological, renal or other complications of diabetes mellitus that could result in sudden or unpredictable incapacitation when exercising the privileges of a licence.

3. Persons with diabetes mellitus controlled by diet and oral hypoglycaemic drug(s) may receive unlimited medical certification at Class 2 or 3 levels only. Such persons who seek Class 1 (re-)certification may be offered (re-) certification with an *'as or with copilot'* restriction. Prior to their (re-)certification, CASA requires objective evidence that these applicants meet the following criteria:
    - No unacceptable side effects from drugs
    - Evidence of stable blood glucose control
        - No episode of symptomatic hypoglycaemia during the preceding 12 months
        - Glycosolated Haemoglobin (HbA1c), taken within preceding month <7.5%
        - Satisfactory reports as detailed in the previous section, Other Investigations.
    - Absence of neurological, cardiovascular, ophthalmological, renal or other complications of diabetes mellitus that could result in sudden or unpredictable incapacitation when exercising the privileges of a licence.

4. Persons with diabetes mellitus who require insulin treatment do not meet the mandatory medical standards and are not fit for medical certification. However, in appropriate cases, the Director of Aviation Medicine may exercise discretion and issue a Class 2 medical certificate endorsed with the conditions *'as or with co-pilot only'* and *'valid in Australian airspace only'*. Prior to such certification, CASA requires:
    - Evidence of stable blood glucose control
        - No episode of symptomatic hypoglycaemia requiring intervention by others in the preceding 12 months
        - Serial Glycosolated Haemoglobin (HbA1c) estimations at two month intervals over the preceding 6 months—all results <7.5%
        - Satisfactory reports as detailed by CASA.
    - Absence of neurological, cardiovascular, ophthalmological or renal complications of diabetes that could results in sudden or unpredictable incapacitation when exercising the privileges of a licence.