



**MANAGING DIABETES  
IN  
SAINT LUCIA**

**MAY 29<sup>TH</sup> 2006**

**Disclaimer**

These are general guidelines only and may not apply in the case of any particular individual patient. They should be applied bearing in mind the local situation. The health care worker should always use his/her clinical judgement and expertise.

**Duality of Interest**

No duality of interest was identified.

These guidelines are produced by the Ministry of Health, Human Services, Family Affairs and Gender Relations as the national guidelines for the management of Diabetes Mellitus in Saint Lucia

.....  
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## PREFACE

The Caribbean Health Research Council (CHRC) has a mandate to promote health policy decisions and best practice, based on available evidence. Consistent with this brief, the Council produced two manuals: "Managing Diabetes in Primary Care" and "Managing Hypertension in Primary Care in the Caribbean" in 1995 and 1998, respectively. These clinical guidelines were distributed throughout the Primary Health Care system of the entire English speaking Caribbean, targeting all Primary Care doctors, nurses, nurse practitioners and other health care personnel involved in the care of persons with diabetes and hypertension.

Since then, there have been significant advances in the management of these two conditions, hence the need for updated manuals that would take into account the most recent international guidelines and regional expert opinions on the management of high blood pressure, diabetes, obesity and related dyslipidemia.

These manuals are geared to the culture, economic situation and health care systems in the Caribbean and are designed to serve as key tools in improving patient care. Special situations and local conditions (cultural and economic) may call for modified strategies, but the most important goal is to ensure that these diseases are managed effectively, thus reducing morbidity and mortality.

It is hoped that the collaboration between the CHRC, the Pan American Health Organization (PAHO), regional opinion leaders and other agencies will accelerate a more effective and comprehensive approach to the prevention and control of chronic non communicable diseases.

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## INTRODUCTION

The World Health Organization (WHO) estimated the worldwide prevalence of diabetes in adults to be around 173 million in 2002 and predicted that there will be at least 350 million people with Type 2 diabetes by 2030. At present about two-thirds of persons with diabetes live in developing countries and the majority of new cases will originate from these areas. The global increase in the incidence of diabetes is related to high levels of obesity associated with a change from traditional diets, diminishing levels of physical activity, population ageing and increasing urbanization.

Diabetes prevalence has been increasing in most countries of the Region of the Americas. It is estimated that more than 1 in 10 of the adult population of the Region is affected; rising to 1 in 5 in persons over 40 years of age. With current trends and without effective interventions, this prevalence is expected to rise.

Diabetes mellitus is one of the leading health problems in the Caribbean, contributing significantly to morbidity and mortality and adversely affecting both the quality and length of life.

In the Caribbean, higher prevalence in women correlates with higher levels of obesity. There is evidence to suggest that the prevalence of Type 2 diabetes is increasing in children and adolescents, which is also likely to be due to an increasing prevalence of obesity in these groups. Consistent with other reports, a study conducted in Trinidad and Tobago showed that persons of Indian origin had a higher prevalence of diabetes than other ethnic groups, highlighting the relevance of ethnicity as a risk factor.

Diabetes more often affects people of lower socio-economic status who carry a greater disease burden for many reasons including limited access to or utilization of health care, poor nutrition, and sub-optimal physical activity. The disease also places a heavy economic burden on already limited health care resources in the Caribbean. Costs are related directly to treatment of the disease and its complications, and indirectly to loss of earning power in those affected.

Globally, diabetes represents the 3<sup>rd</sup> and 10<sup>th</sup> leading cause of loss of years of potential life among women and men, respectively. In 2000, diabetes mellitus was the 3<sup>rd</sup> leading cause of mortality in the Caribbean region, accounting for approximately 10% of all deaths. Those aged 45-64 years were particularly affected.

The United Kingdom Prospective Diabetes Study (UKPDS) confirmed that approximately 50% of persons with Type 2 diabetes have evidence of both vascular complications and significant deficiency in pancreatic beta cell function at the time of diagnosis. Earlier diagnosis coupled with effective and aggressive treatment may lead to improved outcomes.

In Caribbean populations, diabetes often co-exists with obesity, hypertension and dyslipidaemia. The presence of any one of these conditions should therefore alert the health care provider to the increased likelihood of the existence of the others.

Studies suggest that lifestyle modification at the stage of impaired fasting glycaemia or impaired glucose tolerance (i.e. pre-diabetes) may reduce the risk of developing diabetes by as much as 60%. Achieving diabetes control is also eminently possible through lifestyle change and therapeutic interventions.

This document provides a pragmatic approach to the diagnosis as well as the management of diabetes mellitus at the Primary Care level. The focus is on Type 2 diabetes which affects over 95% of persons with diabetes in the Caribbean. The importance of non-drug or lifestyle management and the need to educate patients, families, communities and health care workers are stressed.

This manual aims to provide management guidelines based on current knowledge and best practice. It is hoped that these guidelines will be systematically applied and thus lead to improved care and outcomes in persons with diabetes in the Caribbean.

**AIM:**

To produce a unified, evidence-based approach to the management of diabetes in Saint Lucia

**OBJECTIVES:**

- To prevent or delay the onset of diabetes mellitus and co-morbid conditions of obesity, hypertension and dyslipidaemia
- To promote earlier diagnosis of diabetes mellitus
- To improve the quality of care of persons with diabetes mellitus
- To prevent and treat acute and long-term complications of diabetes mellitus
- To promote education and empowerment of the patient, family and community, and health care worker

## OVERVIEW OF DIABETES MELLITUS

Diabetes mellitus is defined by the World Health Organization as a metabolic disorder characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both.

The symptoms of marked hyperglycaemia include:

- Polyuria
- Polydipsia
- Weight loss which may sometimes be associated with polyphagia.
- Blurred vision

There are several types of diabetes mellitus which may be classified as follows:

### 1. Type 1 Diabetes Mellitus

Type 1 diabetes occurs in young people. The onset of illness is usually abrupt and associated with ketoacidosis. These patients require insulin and must be referred urgently to a diabetes specialist or emergency department when acutely ill.

### 2. Type 2 Diabetes Mellitus

Type 2 diabetes occurs mainly in older persons and is associated with overweight and lack of physical activity. There is also a marked family history in persons with this disease. Type 2 diabetes is associated with the metabolic syndrome.

### 3. Gestational Diabetes

Gestational diabetes refers to glucose intolerance developing during pregnancy. Persons with this condition must be referred for specialist care. This condition is a recognized risk factor for the subsequent development of diabetes mellitus.

### 4. Other types of Diabetes Mellitus

Specific genetic defects or diseases of the exocrine pancreas such as complications of pancreatitis, endocrinopathies, or exposure to specific drugs or chemicals can lead to other types of diabetes mellitus.

Types 1 and 2 are the main types of diabetes and a summary of their usual presentation is found in Table 1.

**Table 1: Presentation of Types 1 and 2 Diabetes Mellitus**

<b>Features</b>	<b>Type 1 (Formerly insulin-dependent diabetes- IDDM)</b>	<b>Type 2 (Formerly non-insulin-dependent diabetes- NIDDM)</b>
Occurrence	Accounts for about 5% of cases	Accounts for about 95% of cases
Pathogenesis	Auto-immune pancreatic beta cell destruction	Relative insulin deficiency and insulin resistance
Age of onset	Usually before age 30 years	45 years and above (but diagnosis at an earlier age appears to be increasing)
Onset	Abrupt	Gradual
Insulin requirement	Insulin therapy required for survival	May initially be managed by lifestyle changes and oral glucose-lowering agents, but eventually may require insulin for control
Ketosis	Ketosis prone	Ketosis resistant except with severe stress
Family history	Minor	Marked

# **SECTION I**

## **SCREENING AND THE DIAGNOSIS OF DIABETES MELLITUS**

“Overall, at least 50% of those with diabetes do not know that they have the condition. In developing countries the proportion with undiagnosed diabetes is considerably higher. At the time of diagnosis, every second person with diabetes has already developed one or more micro-or macrovascular complications.”

*Diabetes Voice  
Dec 2003*

### **Risk Factors for Type 2 Diabetes Mellitus**

- Overweight (Body Mass Index  $\geq 25$  kg/m<sup>2</sup>)
- Age 45 years and older
- Physical inactivity
- Family history of diabetes
- Prior gestational diabetes or history of delivering a baby  $>4$  kg (9 lb)
- Polycystic ovary syndrome
- History of Impaired Glucose Tolerance (IGT) or Impaired Fasting Glucose (IFG)
- HDL-C level  $\leq 40$  mg/dL ( $\leq 1.03$  mmol/L) and/or Triglyceride level  $\geq 150$  mg/dL ( $\geq 1.69$  mmol/L)
- Race/ethnicity (e.g. persons of Asian and African descent)
- Presence of coronary artery disease and/or hypertension (blood pressure  $\geq 140/90$  mm Hg)
- Presence of other vascular complications (angina, PAD)
- Fungal and yeast infections

### **Screening for Type 2 Diabetes Mellitus**

Screening involves the testing of individuals who are at risk of having the disease. Population-based screening is expensive and therefore priority should be given to persons with identifiable risk factors. However, where possible and affordable, population-based screening should be encouraged.

Reasons for screening include:

- There is a rising prevalence in the Caribbean.
- Diabetes is an important public health problem as Caribbean populations are, by definition, high-risk.
- There is a long, latent asymptomatic period in which the condition can be detected
- At the time of diagnosis, significant numbers of individuals already have evidence of the micro-vascular complications of diabetes and may also have macrovascular disease.
- There is evidence that early treatment improves long-term outcome.

### **The Screening Test**

The fasting plasma glucose (FPG) is the recommended screening test. The 75 gm Oral Glucose Tolerance Test (OGTT) is more sensitive for detecting glucose intolerance but is not recommended for screening as it is more expensive and less practical.

Testing of glucose in the urine is **not** recommended for screening. Blood glucose testing by glucometers may play a role in initial screening but **cannot** be used for diagnosis. Any abnormal results **must** be confirmed by measurement of plasma glucose.

If the test result is normal but the client is 45 years or older (particularly if overweight) re-screening would be appropriate at 3-yearly intervals. If the person is overweight and has additional risk factors such as a positive family history or co-morbid disorders, re-screening should be done more frequently.

### **Diagnostic Criteria and Classification of Diabetes Mellitus**

*The diagnosis of diabetes mellitus must be based on laboratory venous blood test results.*

*Glycosuria and finger-prick glucose measurements using a glucometer should not be used for the diagnosis of diabetes.*

*The HbA1c test is not recommended for diagnostic purposes.*

We recommend that the diagnosis of diabetes mellitus be made using the criteria of the American Diabetes Association (ADA).

**Table 2: Criteria for the Diagnosis of Diabetes Mellitus**

**1. Symptoms of diabetes plus casual plasma glucose concentration  $\geq 200$  mg/dL ( $\geq 11.1$  mmol/L).**

**Casual is defined as any time of day without regard to time since last meal.**

**Or**

**2. FPG  $\geq 126$  mg/dL ( $\geq 7.0$  mmol/L). Fasting is defined as no caloric intake for at least 8 h.**

**Or**

**3. 2-h post-load glucose  $\geq 200$  mg/dL ( $\geq 11.1$  mmol/L) . The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.**

In the absence of unequivocal hyperglycemia, these criteria should be confirmed by repeat testing on a different day. The third measure (OGTT) is not recommended for routine clinical use.

### Diagnostic Criteria for Impaired Fasting Glucose and Impaired Glucose Tolerance

If the FPG ranges from 100–125 mg/dL (5.6-6.9 mmol/L) or the blood sugar 2 hours after a 75 gm glucose load is between 140-199 mg/dL (7.8-11.1 mmol/L), an individual is considered to have impaired fasting glucose (IFG) or impaired glucose tolerance (IGT) respectively, and is classified as ‘pre-diabetes’.

Such persons are at high risk of developing diabetes and cardiovascular disease. Indeed impaired fasting glucose and impaired glucose tolerance frequently co-exist with other cardiovascular risk factors giving rise to the Metabolic Syndrome.

**Table 3: Criteria for the Diagnosis of Impaired Fasting Glucose and Impaired Glucose Tolerance**

	Fasting Plasma Glucose		2h Plasma Glucose
Normal	≤100 mg/dL (≤5.5 mmol/L)	and	<140 mg/dL (<7.8 mmol/L)
Impaired Fasting Glucose (IFG)	100–125 mg/dL (5.5-6.9mmol/L)		
Impaired Glucose Tolerance (IGT)			140–199 mg/dL (7.8-11.1 mmol/L)

*Source:* Adapted from the American Diabetes Association 2005

### The Metabolic Syndrome

The metabolic syndrome is characterized by the co-occurrence of obesity (especially central obesity), dyslipidaemia (especially high levels of triglycerides and low levels of high density lipoprotein cholesterol), hyperglycaemia and hypertension. The diagnosis of metabolic syndrome is made if an individual has three or more of the characteristics shown in Table 4.

There is a large overlap between the Metabolic Syndrome and pre-diabetes. Persons with the metabolic syndrome are at increased risk of developing diabetes.

The diagnosis of the metabolic syndrome is made by the criteria of:  
Central obesity (1) and any two of 2,3, 4 or 5 in table 4 below.

**Table 4: Criteria for Identification of the Metabolic Syndrome**

	<b>Feature</b>	<b>Criterion</b>
1	Central obesity (waist circumference) - Men - Women	>94 cm (37 in) > 80 cm (32 in)
2	Fasting Blood Glucose	≥100 mg/dL (≥5.5 mmol/L)
3	Blood Pressure	≥130/85 mm Hg
4. Fasting lipids	HDL Cholesterol - Men - Women	<40 mg/dL (<1.03 mmol/L) <50 mg/dL (<1.3 mmol/L)
5 Fasting lipids	Triglycerides	≥150 mg/dL (≥1.69 mmol/L)

*Source:* 2005 IDF

## **SECTION II**

### **EFFECTIVE DELIVERY OF CARE**

“The establishment of a practice which puts the person at the centre of care will require a change in the attitudes and beliefs of health professionals and people with diabetes.”

Diabetes Voice  
May 2004

## **REQUIREMENTS FOR THE EFFECTIVE DELIVERY OF CARE**

Some of the requirements for the effective delivery of care are adequate personnel, facilities, equipment and supplies. Good information and referral systems are also essential elements.

### **Personnel**

The management of diabetes depends on the functioning of a **multidisciplinary** team. The composition of the team will depend on the country's resources but should include:

- Medical Doctor/Nurse Practitioner
- Nurse
- Diabetes Educator
- Nutritionist/Dietitian
- Podiatrist/Chiropodist
- Pharmacist
- Social Worker

There should be access to other health professionals such as an endocrinologist or diabetes specialist, physiotherapist, psychologist, ophthalmologist and nephrologist.

The staff should be trained to ensure that the services are patient-centred and to accept the patient as an important member of the team who should be fully involved in his/her care.

### **Facilities**

The facilities should be easily accessible to persons with disabilities. Adequate space should be provided for:

- Registration of the patient
- Education and counselling
- Physical examination

There should be access to laboratory services.

### **Equipment and Supplies**

Equipment related to the management of diabetes should be available. These include:

- Glucose monitors
- Testing materials such as glucometers strips, lancets, etc
- Beam balance scale and stadiometer
- Measuring tape (non-stretch), tuning fork, ophthalmoscope, 10 G monofilament

- Audiovisual equipment and printed material for patient and staff education

### **Information System**

The information system plays an important role. The system should include:

- records for collection of client information
- mechanism for client recall- annual reviews etc....
- system for assessing quality of care
- practice audits (checklist of indicators of quality)

### **PATIENT VISITS**

The person with diabetes should have regular contact with the health system. The following is a suggested schedule of visits and activities.

#### **The Initial Visit**

##### *Medical History*

A comprehensive medical history should be elicited to determine the client's baseline information. This includes:

- Symptoms
- History of other medical conditions
- Medications being used
- Risk factor assessment
  - Smoking
  - Alcohol intake
  - Exercise patterns
  - Nutrition
  - Family history of diabetes, hypertension, vascular disease
  - Psychosocial assessment
- Identify factors that may affect management of diabetes
  - Cultural
  - Educational
  - Socio-economic

If patient is already being treated:

- Obtain results of previous test results
- Obtain information about previous treatments

### ***Physical Examination***

A thorough physical examination should be done paying special attention to:

- Height and weight to determine BMI (See Appendix I)
- Waist circumference

See “***Protocol for the Nutritional Management of Obesity, Diabetes and Hypertension in the Caribbean***”, produced by the CFNI, for further details.

- Blood pressure (including checks for orthostatic hypotension)
- Skin for evidence of infections, ischaemia, ulcers and state of insulin injection sites
- Eyes for evidence of diabetic retinopathy (such as microaneurysms, haemorrhages and exudates), visual acuity
- Mouth for gingivitis, periodontitis
- Heart for cardiomegaly and murmurs
- Abdomen for hepatomegaly
- Feet for evidence of peripheral artery disease and neuropathy
  - Appearance- colour, evidence of atrophy, nails, ulcers
  - Sensation, reflexes, vibration
  - Pulses- dorsalis pedis, posterior tibial
- Neurological system for evidence of cranial and peripheral neuropathy

### ***Laboratory Tests***

The following laboratory tests should be conducted:

- Blood
  - Haemoglobin
  - Fasting Plasma glucose
  - HbA1c
  - Fasting lipid profile- low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C), Triglycerides (TG)
  - Serum creatinine

If clinically indicated

- Thyroid function tests
- Liver function tests
- Urine
  - Ketones, Protein
  - Where available, tests for microalbuminuria

- Other tests
  - CXR
  - Electrocardiogram
  - Echocardiogram
  - Doppler

### ***Referrals***

Where available the client should be referred to the following personnel:

Nutritionist/Dietitian  
 Chiropodist/Podiatrist  
 Diabetes Educator  
 Medical Social Worker  
 Ophthalmologist  
 Other specialists as indicated

### **Follow-Up Visits**

Please see Appendix II for the Diabetes Management Flow Sheet.

### ***Every visit***

#### All patients

- Measure weight
- Waist circumference
- Determine BMI (using initial height)
- Measure blood pressure
- Review self-monitoring or monitoring of blood glucose results and reinforce its importance
- Elicit information on adherence to treatment
- Ask about symptoms including those of hypoglycaemia
- Conduct visual inspection of feet
- **Give advice on nutrition and physical activity.**

#### Insulin treated patients

- Inspect injection sites
- Ask about occurrence of hypoglycaemic attacks
- Test urine for ketones

### ***Every 3-6 Months***

- Measure HbA1c

## *Annual Review for All Patients*

### General

- Measure weight
- Determine BMI
- Measure waist circumference
- Measure blood pressure
- Ask about frequency of smoking and alcohol use
- Review diet - especially if overweight or plasma glucose and/or HbA1c are unacceptable
- Ask about mental health (especially depression)
- Ask about decreased libido and erectile dysfunction

### Physical Examination

Pay special attention to:

- Feet
- Eyes
- Mouth

### Laboratory Investigations

#### **Blood**

- HbA1c
- Lipids
- Creatinine

#### **Urine**

- Microalbuminuria

### Other Test

- Electrocardiogram for persons over 40

## **SECTION III**

### **CONTROL OF BLOOD GLUCOSE, BLOOD PRESSURE AND BLOOD LIPIDS**

**Table 5: Metabolic, Blood Pressure and Nutritional Targets for Control in Diabetes Mellitus and Associated Conditions**

<b>Measurement</b>	<b>Good</b>
<b>Blood glucose</b>	
- Preprandial	100 mg/dL (5.5 mmol/L)
- Postprandial	<140 mg/dL ( <7.8 mmol/L)
<b>HbA1c</b>	<6.5%
<b>Total cholesterol</b>	<200 mg/dL ( < 5.2 mmol/L)
<b>HDL cholesterol</b>	>40 mg/dL (M) (>1.0 mmol/L) >50 mg/dl (F) (>1.3 mmol/L)
<b>LDL cholesterol</b>	<70 mg/dL (<1.8 mmol/L)
<b>Fasting triglycerides</b>	<150 mg/dL (<1.7 mmol/L)
<b>Blood Pressure</b>	≤120/80 mmHg
<b>Body Mass Index</b>	18.5 - 25 kg/m <sup>2</sup>
<b>Waist circumference</b>	
Women	<80 cm (<32")
Men	<94 cm (<37")

“Lifestyle measures, principally changes in nutritional habits and physical activity, may reverse some of the glucose, lipid and blood pressure disorders of diabetes.”

Diabetes Voice  
May 2003

## ACHIEVING GLYCAEMIC CONTROL

### Non Pharmacological Management of Hyperglycaemia

Weight management, diet and physical exercise should be the first line of treatment for diabetes mellitus and should be maintained throughout the course of the disease. In addition to improving glycaemic control, these interventions also slow progression of impaired glucose tolerance to overt diabetes.

### Nutritional Management

#### Assess

Nutritional status using BMI (See Appendix 1) or waist circumference

- Body mass index (BMI) has been the traditional index of obesity and usefully identifies the risk of diabetes and cardiovascular disease in a given population.
- Waist Circumference  
The waist circumference is a marker of visceral adiposity and a strong predictor of diabetes and cardiovascular disease risk.

#### Elicit

Information on dietary practices

#### Advice on Nutrition

- Overweight patients should reduce calorie intake i.e. eat smaller portions and increase physical activity.
- Limit intake of fats and oils; avoid fried foods.
- The intake of saturated fat, margarine and hydrogenated oils should be reduced.
- Consumption of red meat should be limited and increased intake of fish, white meat and legumes encouraged.
- Increased intake of complex carbohydrates and high fibre foods should be encouraged.
- The intake of refined carbohydrates (sugars) should be reduced.
- The intake of salt and high sodium foods should be reduced.
- Eat a variety of foods and include fresh fruits and vegetables.
- Meals should be evenly distributed throughout the day. Breakfast, lunch and dinner should be taken at fairly regular times with mid morning, mid afternoon and bedtime snacks. This is especially important for patients treated with insulin.

See also Appendix II for the recommended composition of health diets.

### Refer

To nutritionist/dietitian where available, especially for new patients or if dietary indiscretion is recognized

See “*Protocol for the Nutritional Management of Obesity, Diabetes and Hypertension in the Caribbean.*”

### ***Physical Activity***

Physical inactivity and overnutrition leading to obesity, are major contributors to the increasing levels of Type 2 Diabetes worldwide. Physical activity is therefore a key factor both in the prevention and management of Type 2 diabetes.

### Assess

Physical activity levels

Advise clients about the benefits of regular physical activity which include:

- Improvement in glycaemic control
- Prevention of cardiovascular disease
- Reduction in hypertension
- Reduction in levels of VLDL and increase in HDL cholesterol levels
- Enhancement of weight loss or maintenance of weight
- Improvement in mental health (helps counter anxiety and depression)

Meeting the requirements for physical activity does not require a formal exercise regime. Physical activity can be incorporated into the activities of daily living. See Table 6.

Regular aerobic activity should be sustained for 30-60 minutes at least 5 times weekly. The level and intensity of physical activity should be guided by the age and ability of the patient.

**Table 6: Guide to Physical Activity Levels**

<b>Level of Activity</b>	<b>Examples</b>
Light	Office work, cleaning house, playing golf, walking
Moderate	Walking briskly, gardening, cycling, tennis, dancing, swimming, light weight training, climbing stairs
Strenuous	Jogging, competitive swimming and tennis, aerobic workout, vigorous dancing
Very Strenuous	Running, intense aerobic workout, intense weight training, football

Note: These are simply a few examples. Physical activity levels will be determined by the degree of exertion. Before commencing a physical activity program, persons with diabetes should be assessed by a medical doctor.

Elicit medical history including:

- Present status of disease including, symptoms, treatment, complications
- Cardiac history
- Family history

Conduct physical examination including:

- Measurement of BMI, waist circumference
- Cardiac assessment
- Identification of complications of diabetes
- Foot examination

*The history and physical examination should reveal any precautions that must be taken.*

Contraindications to exercise

- Uncontrolled hyperglycaemia
- Unstable angina
- BP >200/100 mmHg
- Acute heart failure
- Febrile illness

Patient Advice about Exercising

- Warm up before and cool down after exercise
- Wear proper footwear
- Monitor feet closely for blisters or any other damage to feet
- If exercising away from home, wear identification
- Ensure adequate intake of fluids
- Eat appropriately and modify insulin as necessary

### **Pharmacological Management of Hyperglycaemia**

Currently, the main therapeutic options for the treatment of Type 2 Diabetes are:

- Biguanides- Increase insulin sensitivity
- Thiazolidinediones- Increase insulin sensitivity
- Sulfonylureas- Increase insulin release
- Meglitinides- Increase insulin release
- Alpha-glucosidase inhibitors- Modify intestinal absorption of carbohydrates
- Insulins- Replace insulin

Combinations of these classes of drugs are frequently required for optimum control.

Low dose combination therapy could be considered early in the disease as it improves the efficacy of therapy and minimises side effects.

## Oral Glucose-Lowering Agents

Therapy with oral agents should be introduced when the blood sugar is not controlled by diet and exercise after 4-6 weeks.

The majority of persons with diabetes, even if initially controlled on non-pharmacological measures, will eventually require drug therapy in increasing dosages and often in multiple drug regimens. Many subsequently require the addition or substitution of insulin for glycaemic control, the so-called *secondary failure*. A subset of patients with apparent Type 2 Diabetes Mellitus may require insulin for control somewhat earlier than expected- *primary failure* of response to oral therapy.

**Table 7: Profile of Principal Oral Glucose-Lowering Agents**

Class	Action	Advantages	Contraindications	Side effects	Dosing
<b>Biguanides</b> Metformin (This is the only drug used in this class.)	Reduce hepatic glucose output and delay glucose absorption from the gut	Do not cause weight gain Lower LDL cholesterol Do not cause hypoglycaemia	Renal insufficiency Hepatic insufficiency Severe heart failure	Lactic acidosis Gastrointestinal problems	Start with 500 mg once or twice daily with meals
<b>Sulphonylureas</b> Gliclazide, Glimepiride Glipizide Glyburide (short acting)	Stimulate insulin release	Low cost Effective	Pregnancy Lactation	Hypoglycaemia	Short acting drugs preferable for use in the elderly Start with a low dose and increase as necessary
<b>Meglitinides</b> Repaglinide	Increase insulin release	Rapid on-off effect due to short half life	Pregnancy Lactation	Gastrointestinal upset Hypoglycaemia	Multiple dosing regimen is necessary
<b>Alpha glucosidase inhibitors</b> Acarbose	Reduce intestinal absorption of carbohydrates	Do not cause hypoglycaemia	Pregnancy Kidney disease Cirrhosis	Gastrointestinal symptoms	Start with low dose 25 mg 2-3 times daily (Take with the first bite of each main meal) Increase to maximally tolerated dose
<b>Thiazolidinediones</b> e.g. Rosiglitazone Pioglitazone	Increase insulin sensitivity	Beneficial effects on lipids and blood pressure	Cardiac failure Liver disease Caution when used with insulin	Water retention Weight gain	Can be used as monotherapy or in combination with other oral agents or insulin

### Note

- 1) The current cost of thiazolidinediones and meglitinides prohibits their ready use in Primary Care. However they can be used as first line drugs where indicated.
- 2) Chlorpropamide, a long-acting sulphonylurea is not recommended. **Where still available, it should be used with extreme caution in the elderly and should be avoided in those with renal disease.**

## Insulin

### The indications for insulin treatment are:

- All Type 1 patients
- Patients with Type 2 diabetes, whose metabolic control is chronically inadequate-evidenced by an HbA1c >6.5% despite adequate diet, weight reduction, exercise and maximum dosages of oral hypoglycaemic agents
- To cover acute illness, surgery or pregnancy (See Appendix IV)
- Treatment of diabetic ketoacidosis or hyperglycaemic/hyperosmolar non-ketotic diabetic states
- Post-myocardial infarction

**Patients with Type 2 Diabetes who are failing or have failed oral therapy can be safely and effectively started on insulin in the outpatient setting, with proper advice and training by the health care team.**

### Determining total Insulin dose

When initiating insulin therapy baseline total daily insulin dose is often calculated as 0.3-0.5 x body weight in Kg.

**Table 8: Types of Insulin Available**

Type of Insulin	Examples
Rapid-acting	Insulin lispro Insulin aspart
Short-acting	Regular Humalog
Intermediate	NPH, Lente Ultralente
Long-acting	Glargine Detamir
Pre-mixed	70% NPH: 30% Regular 80% NPH: 20% Regular

### Note:

- Regular insulin should be injected subcutaneously 15-30 minutes before a meal for the onset of action to coincide with food absorption.
- Humalog (an analogue insulin) can be given at the start of the meal.

### Mixing of Insulins:

- If Lente or Ultralente is mixed with Regular insulin in a syringe, it should be injected immediately, or the action of the Regular insulin becomes impaired.
- Glargine should **not** be mixed in the syringe with other insulins **nor** injected at the same site as other insulins.
- If it is necessary to mix short and long acting insulin, then NPH is preferable to Lente in mixing with Regular insulin.
- When insulins are mixed, the Regular insulin should be drawn up first before the Lente or Ultralente.

### Possible Insulin Regimens In Type 2 Diabetes Mellitus

#### 1) Combined oral agents and insulin:

- Morning: Oral agents e.g. Metformin or Sulphonylureas or Thiazolidinediones
- Bedtime: Glargine or NPH insulin: Start with 10 - 15 units and adjust to achieve target fasting values.

#### 2) Twice Daily Regimen of Both 'Regular' and 'NPH' Insulin

Use the 'Rule of Thirds'

1/3 short-acting insulin and 2/3 long-acting insulin

2/3 of daily dose in morning and 1/3 in evening

#### Example

Assuming a total dose of 45 units of insulin is required per day for control

	<b>Regular</b>	<b>NPH</b>
A.M: 2/3 of total daily dose (30 units)	10	20
P.M: 1/3 of total daily dose (15 units)	5	10

#### 3) Multiple Dosing Regimen:

Short-acting analogue e.g. Regular analogue immediately before each main meal together with long acting analogue insulin at bedtime e.g. Glargine

This regimen is useful in patients with little control or those who desire flexibility due to their lifestyles. High levels of motivation, frequent testing and adjustment of dosages are necessary for good control on this regimen.

Whenever possible, it may be useful to get input from a diabetes specialist.

## Step wise approach to diabetic management

<p><b>Newly diagnosed Type 2 diabetes</b> 3-month trial of lifestyle modification</p> <ul style="list-style-type: none"> <li>– Diet</li> <li>– Exercise</li> <li>– Stop smoking</li> </ul>	<p><b>STEP 1</b> Start – Metformin Titrate to maximal tolerated dose</p> <p>Or if:</p> <ul style="list-style-type: none"> <li>– <i>unable to tolerate metformin</i></li> <li>– <i>metformin contraindicated</i></li> </ul> <p><i>use an insulin sensitiser (glitazone)</i> or <i>use a sulphonylurea</i></p>	<p><b>STEP 2</b> Add a sulphonylurea</p> <p>or</p> <p>add a insulin sensitizer (glitazone) or post-prandial glucose regulator</p>	<p><b>STEP 3</b> Add additional oral hypoglycaemic agents</p> <p>or</p> <p>convert to insulin therapy +/- oral agent</p>
<p><b>Test HbA<sub>1c</sub> 3 months after initial diagnosis</b></p>	<p><b>Review patient every 2–6 months</b> If HbA<sub>1c</sub> remains &gt; 7% move on to the next treatment step</p>		

## MONITORING OF BLOOD GLUCOSE

### Self-Monitoring of Blood Glucose

Self-monitoring of blood glucose (SMBG) is a major component in the achievement of good glycaemic control. SMBG is particularly useful in persons with Type 1 diabetes but may also play a critical role in the management of persons with Type 2 Diabetes.

The main functions of SMBG are:

- To provide persons with diabetes with information about their response to therapy. This information can be used to make adjustments to diet, medication and physical activity
- To foster the partnership between the patient and the health care team as results obtained by the patient may be used to modify treatment regimens

- To detect hypoglycaemia especially in those who may be ill or unaware of relevant symptoms
- To allow persons with diabetes to be aware of the status of their blood glucose control without being solely dependent on health care professionals
- To empower persons with diabetes

An **individualized home monitoring plan** is required and must be agreeable to the patient and health care workers. The plan should include the timing and frequency of tests. Frequency will vary according to the type of diabetes, the medication prescribed and the level of glycaemic control.

Testing should be done in the fasted state as well as before and after meals. For persons with Type 1 Diabetes and pregnant women on insulin, SMBG should be done at least three times per day. Recorded results should be presented to health care professionals at clinic visits. The person's ability to adjust treatment, food and physical activity according to the results should also be monitored.

SMBG may not be suitable for everyone with diabetes. The patient should be able to perform the test accurately, following the manufacturer's instructions, and must know what results to expect and what action to take if the results are outside the desired range.

Major limitations of SMBG are:

- the cost of the testing strips and
- difficulties experienced by some persons in pricking themselves (needle phobia).

### **Blood Glucose Monitors**

There is usually a reasonable correlation between glucose concentrations measured in capillary blood by glucose meters and those from serum or plasma glucose measured by clinical laboratory procedures.

### **Blood Glucose Testing**

The technique of testing should be taught by members of the health care team who should ensure that the test is being done accurately.

It is important to ensure that strips match the machine.

Strips must be stored according to recommendations of the manufacturers.

## **HbA1c**

This test is used in combination with self-monitoring of blood glucose to assess long-term control.

Testing should be done as a minimum once every 6 months.

## **Urine Testing**

- Urine testing for glucose is *not recommended for evaluating control*. In settings where this may be the only available option for monitoring glycaemic control, persistent glycosuria highlights the need for the patient to seek further medical attention.
- Urine testing for ketones is important during sick days especially for Type 1 diabetes. (See Appendix IV)

## **HYPOGLYCAEMIA**

Hypoglycaemia/Hypo is used to describe blood sugar levels below 4 mmol/L.

### **Possible causes:**

- More exercise than normal
- Too little food
- Missed or late meals
- Too much insulin/tablets
- Alcohol consumption
- Menses
- Hot weather

### **Signs and symptoms include:**

- |             |                           |
|-------------|---------------------------|
| • Sweating  | Hunger                    |
| • Shaking   | Blurred vision            |
| • Dizziness | Headaches                 |
| • Tiredness | Tingling lips/finger tips |

### **May also notice:**

- Glazed eyes
- Mood changes
- Unusually aggressive behaviour

## The Three Stages of Hypoglycaemia

### *1. Mild Hypoglycaemia*

Characterized by shaking, sweating, hunger, weakness and anxiousness

#### Treatment

Self-treatment of 10 to 15 grams of pure glucose, wait 10 minutes and follow with a protein such as 8 oz. of milk or cheese and crackers or bread. If untreated, it progresses to moderate hypoglycemia.

### *2. Moderate Hypoglycaemia*

Characterized by confusion, slurred speech, glassy eyes, poor coordination and lack of concentration

#### Treatment

Assistance may be required. Take a 20 to 30 gram dose of pure glucose, wait 10 minutes then follow with a protein such as 8 oz. milk or cheese and crackers or bread. If untreated, it progresses to severe hypoglycaemia.

### *3. Severe Hypoglycemia*

Characterized by unresponsiveness, combativeness, agitation, convulsions and unconsciousness

#### Treatment:

**This is an acute medical emergency. Seek medical assistance.**

Severe hypoglycemia can be life threatening if not treated promptly and thoroughly. Emergency measures are required, including injection of glucagon or intravenous dextrose, followed by oral glucose or sweetened drinks.

**Hospital admission is indicated for severe or prolonged hypoglycaemia, co-existing renal disease or illness associated with use of long acting oral glucose lowering agents. The usual dose of insulin/diabetic medication may need to be modified , once the hypo episode has been treated.**

Encourage patients to carry glucose and snacks at all times.

## CONDITIONS IN DIABETES MELLITUS REQUIRING HOSPITAL ADMISSION

- Newly diagnosed diabetes in children and adolescents or in pregnancy
- Uncontrolled diabetes
  - Chronic refractory hyperglycaemia associated with metabolic deterioration
  - Inability to obtain glycaemic control with outpatient therapy
  - Recurrent hypoglycaemia
  - Metabolic instability characterized by frequent swings between hypoglycaemia and hyperglycaemia
  - Recurrent diabetic ketoacidosis in the absence of trauma and infection
  - Uncontrolled diabetes in pregnancy
- Institution of intensive insulin regimes including insulin-pump therapy
- Potentially life-threatening acute complications of diabetes
  - Diabetic ketoacidosis characterized by hyperglycemia, acidosis and ketones in the urine and/or blood
  - Hyperglycemic hyperosmolar state characterized by severe hyperglycemia and elevated serum osmolality often with concomitant alterations in mental status
  - Hypoglycemia with neuroglycopenia characterized by altered consciousness, seizures, coma, or disturbances of motor or language function, where there has not been prompt full recovery following glucose therapy, a sulfonylurea drug has been implicated, or there is concern about patient supervision or monitoring.

## MANAGEMENT OF ASSOCIATED CONDITIONS

Because of the interrelationship of diabetes with co-morbidities, there is a need for those conditions to also be controlled to prevent or delay complications and improve quality of life.

**NSAIDS should be avoided.**

### **Hypertension Management in Adults with Diabetes**

There is a higher prevalence of hypertension among persons with diabetes compared with non-diabetics. In the Caribbean diabetes is present in about one-third of hypertensive patients. This co-existence is often a result of:

- The high prevalence of both conditions in the Region
- The relationship between insulin resistance and hypertension
- The higher prevalence of chronic renal disease among diabetic patients

Hypertension increases the risk of strokes, ischaemic heart disease, retinopathy and nephropathy in persons with diabetes.

The target blood pressure should be <130/80 mm Hg. However, attaining systolic pressures of <120 mm Hg is desirable.

Such targets may be difficult to achieve in the elderly and more modest goals may have to be set.

## ***Management***

### Non-drug Treatment

- Weight management must be recommended for all persons with diabetes. Caloric restriction and any degree of weight loss are beneficial for the overweight or obese patient.

The intake of potassium and calcium must be adequate and sodium intake limited. Increased consumption of fruits and vegetables is to be encouraged as well as the use of low fat dairy products. A balanced diet will provide all the essential nutrients and vitamins without the need for supplementation.

See ***“Protocol on the Nutritional Management of Obesity, Diabetes and Hypertension in the Caribbean”*** for further details.

- Smoking cessation is critical for reducing the risk of vascular complications of hypertension and diabetes.
- Alcohol intake should be limited as it compromises the control of both diabetes and hypertension.
- Physical activity should be continued unless specifically contraindicated.

### Drug Treatment

- Most persons with hypertension and diabetes will need 2 or more drugs for control, in addition to lifestyle changes.
- Low-dose thiazides e.g. bendrofluzide or hydrochlorthiazide can be used safely in the majority of diabetics. Thiazides, used in low doses, rarely affect glucose, lipids or electrolyte balance and should be the antihypertensives of first choice. However ensure uric acid levels are determined.
- Diuretics, ACE inhibitors, angiotensin receptor blockers (ARBs) and calcium channel blockers (CCBs) have all been shown to reduce the risk of cardiovascular events.
- ACE inhibitors have been shown to improve cardiovascular outcomes in high-risk patients with or without hypertension and there is compelling evidence for earlier use in persons with diabetes.

- ACE inhibitors or ARBs are the drugs of choice for renal protection in diabetics with proteinuria . In persons who are allergic to ACE/ARBs, the use of the calcium channel blocker Diltiazem has provided similar benefits.
- Beta-blockers have a place in the management of persons with diabetes but should be used with caution in persons with peripheral vascular disease. Water soluble forms e.g. Atenolol are preferable.

See “*Managing Hypertension in Saint Lucia*” for further details.

### **Lipid Management in Adults with Diabetes**

Type 2 Diabetes mellitus is associated with increased prevalence of lipid abnormalities (viz. increased low density lipoproteins (↑LDL-C), decreased high density lipoproteins (↓HDL-C) and increased triglycerides (↑TG), which contribute to macrovascular disease (heart attacks and strokes).

Lowering LDL cholesterol and triglycerides and raising HDL cholesterol have been shown to reduce macrovascular disease events as well as mortality.

#### ***General Points***

- Diet and exercise remain the cornerstone of treatment of dyslipidaemia.
- Pharmacological therapy is often required to achieve targets and should be implemented in conjunction with lifestyle changes.
- Routine screening of all diabetes patients for dyslipidaemia is to be encouraged through annual testing.

#### ***Treatment***

##### LDL-cholesterol

- Aim for LDL-cholesterol <70 mg/dL (<1.8 mmol/L). Statins are the drug of choice.

##### HDL-cholesterol

- Aim for >40 mg/dL (>1.0 mmol/L)
- Nicotinic acid (Niacin) is the most effective drug for raising HDL-C but has limited usage in clinical practice, as a result of an unpleasant flushing reaction. When used, doses should be restricted (e.g. 500–1000 mg per day) to reduce the likelihood of hyperglycaemia.

##### Hypertriglyceridaemia

- Aim for <150mg/dL (<1.7 mmol/L)

- This derangement frequently responds to calorie and alcohol restriction. Adequate glycaemic control also contributes to reductions in triglyceride levels.
- Fibrate therapy (e.g. Gemfibrozil) may be necessary if these measures fail.

### ***Statin therapy***

- Patients with diabetes who have other cardiovascular risk factors (such as hypertension, smoking or microalbuminuria), may benefit from the addition of a statin irrespective of initial LDL-cholesterol levels.
- All diabetic patients with cardiovascular disease (angina, myocardial infarction, transient ischaemic attack, stroke, and claudication) should be on cholesterol-lowering medication.
- Combination therapy with a statin and fibrates may be used for mixed lipid disorders but the risk of rhabdomyolysis is increased.
- Note that liver function should be evaluated before commencement of statin therapy

### **Other Therapeutic Interventions**

The following therapies may be considered in the management of diabetes and associated conditions.

- Anti-thrombotics

Aspirin (75-325 mg daily) should be given to all persons with diabetes over age 40 years who do not have a contra-indication to aspirin therapy **and** who have two or more risk factors for cardiovascular disease.

#### ***Note***

*Higher doses will increase the possibility of gastric mucosal injury and gastrointestinal haemorrhage.*

*Aspirin is not recommended for persons under age 21 years because of increased risk of Reye's Syndrome*

Alternative therapies include the combination of aspirin with an H2 antagonist or proton pump inhibitors or the use of Clopidogrel.

- Anti-obesity drugs

These drugs should only be used when absolutely necessary. Current choices include Orlistat and Sibutramine

## **SECTION IV**

### **PREVENTION AND REDUCTION OF COMPLICATIONS**

“People with poorly controlled diabetes have a markedly increased risk for and incidence of heart attack, stroke, blindness, kidney failure, leg amputation and early death. Not only is their productive life span shortened, but the quality of life of people with diabetes and their families is severely impacted.”

Declaration of the Americas on Diabetes  
August 1996

The microvascular complications of diabetes mellitus i.e. nephropathy, neuropathy and retinopathy are directly related to the duration and degree of glycaemic control.

## NEPHROPATHY

This is a major cause of end-stage renal disease (ESRD)

### Contributing Factors

- Duration of diabetes (usually >10 years)
- Poor glycaemic control
- Poor blood pressure control
- Genetics- family history of hypertension or renal failure
- High protein intake

### Screening for Nephropathy

Albuminuria is the earliest manifestation of nephropathy

Main methods for screening

- Measurement of urinary albumin/creatinine ratio (ACR)
- 24 hour collection of urine for proteinuria
- Timed collection of urine for microalbumin

**Table 9: Definition of Abnormalities in Renal Albumin Excretion**

Category	Spot collection µg/mg creatinine	24-hr collection mg/24 h	Timed collection µg/min
Normal	<30	<30	<20
Microalbuminuria	30-299	30-299	20-199
Clinical albuminuria	≥300	≥300	≥200

*Source:* American Diabetes Association, Clinical Guidelines of Care, 2005

## **Recommendations to Reduce the Risk of Nephropathy**

- Screen for microalbuminuria **at diagnosis** and then annually in all persons with Type 2 diabetes mellitus.

Once microalbuminuria or proteinuria has been confirmed:

- Include an ACE-inhibitor or ARB in the therapeutic regimen.
- Aim for tight blood pressure control with combination therapy if necessary so that  $BP \leq 125/75$  mmHg.
- Aim for tight glycaemic control.
- Advise on a protein restricted diet and refer to a nutritionist/dietitian for specialized management.
- Refer for specialist care.

## **RETINOPATHY**

Diabetic retinopathy is an important cause of blindness.

### **Contributing Factors**

- Duration of the disease (usually >10 years)
- Poor glycaemic control
- Poor blood pressure control

### **Screening**

Refer all persons with Type 2 diabetes mellitus to an ophthalmologist as soon as possible after initial diagnosis and then annually for dilated fundoscopy. Patients with Type 1 diabetes should have an initial eye examination 3-5 years after the onset of the disease.

### **Recommendations to Reduce Risk of Retinopathy**

- Aim for tight metabolic and blood pressure control
- Refer for specialty care

## **NEUROPATHY**

Diabetic neuropathy occurs mainly in persons with poor glycaemic control. The symptoms are:

- Tingling
- Numbness
- Weakness
- Burning sensations

Symptoms usually start at the periphery (fingers and toes) and move up the limbs.

If the autonomic nervous system is affected, abnormalities of bladder and bowel function and penile erectile dysfunction (ED) may also occur.

## **CARE OF THE FOOT**

Foot lesions are common in persons with diabetes. See Appendix V.

### **Factors that Contribute to Foot Lesions**

- Neuropathy
- Ischaemia
- Injury/Infection
- Incorrect foot wear

### **Recommendations to Reduce the Risk of Foot Problems**

- Aim for tight metabolic and blood pressure control
- Encourage smoking cessation
- Encourage routine daily self-examination of feet
- Encourage use of correct foot wear. Where available, a chiropodist or podiatrist should be consulted when necessary
- Examine peripheral pulses for peripheral vascular disease
- Test feet routinely for peripheral neuropathy
- Refer for specialty care as appropriate
- Inspect feet at each visit
- Identify those at risk and concentrate resources on them. i.e. those with:
  - peripheral neuropathy
  - absent pulses
  - deformities ie bunions, hammer toes, previous foot surgery
- Advise and facilitate patients with new foot problems to consult you that day
- Seek same day surgical opinion if:
  - Any local or systemic signs of a foot related infection.

## **CARDIOVASCULAR DISEASE**

Persons with diabetes are at significantly increased risk of developing cardiovascular disease, which is the major cause of mortality and chronic morbidity.

Cardiovascular disease includes:

- Coronary heart disease, which can lead to angina and myocardial infarction
- Cerebrovascular disease leading to transient ischaemic attacks and strokes
- Peripheral vascular disease

In terms of risk stratification, persons with diabetes should be treated in an identical manner to persons without diabetes who have previously had a heart attack.

In addition to glycaemic and blood pressure control and correction of dyslipidaemias, the following are strongly advised:

- Smoking Cessation
  - Successful smoking cessation is the most effective intervention for both primary and secondary prevention of cardiovascular disease.
  
- Use of Anti-Platelet Agents
  - Primary prevention with an anti-platelet agent should be considered in all patients over the age of 40 years, especially those with multiple risk factors.
  - Aspirin use is beneficial for secondary prevention following myocardial infarction, stroke, peripheral vascular disease, angina or following surgery for any of these conditions.

## **SECTION V**

### **MANAGEMENT OF GESTATIONAL DIABETES MELLITUS**

“Diabetes in pregnancy may give rise to several adverse outcomes.... Strict metabolic control may reduce these risks to the level of those of non-diabetic expectant mothers.”

World Health Organization, Fact Sheet No 138  
April 2002

## **GESTATIONAL DIABETES MELLITUS (GDM)**

Gestational diabetes mellitus is defined as any degree of glucose intolerance with onset or first recognition during pregnancy.<sup>2</sup>

The following categories of patients are at increased risk of GDM:

- > 25 years of age
- overweight
- first degree family history of diabetes
- previous history of abnormal glucose metabolism
- glycosuria
- previous poor obstetric history
- ethnicity associated with high prevalence of diabetes mellitus
- a previous large baby weighing more than 4.0 kg (9lbs)

Gestational diabetes poses a high-risk for both the woman and the child.

Complications of GDM include:

### **Fetus/Child**

- Congenital malformations
- Increased birth weight
- Shoulder dystocia
- Elevated risk of perinatal mortality

### **Mother**

- Hypertension in pregnancy and placental insufficiency may occur more frequently
- Increased insulin resistance
- Development of diabetes-related complications
- Abortion

## **PROTOCOL FOR TESTING FOR GDM**

- 1) Screen with questions related to risk factors as above
- 2) High-risk patients should be tested with the Oral Glucose Tolerance Test

If the first test is normal, **retest** high-risk patients at 24-28 weeks gestation.

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<sup>2</sup> American Diabetes Association 2005 Guidelines of Care

## Diagnostic Criteria

There are two main glucose tolerance tests used for diagnosing gestational diabetes. The test using 100 g glucose is also widely used for detection of 'at risk' infants and mothers.

**Table 10: Glucose Tolerance Tests for Gestational Diabetes**

### 100g glucose (Traditional Method)

Time	mg/dL	mmol/L
Fasting	> 95	> 5.3
1-h	>180	> 10.0
2-h	>155	> 8.6
3-h	>140	>7.8

### 75 g glucose

Time	mg/dL	mmol/L
Fasting	> 95	> 5.3
1-h	>180	> 10.0
2-h	>155	> 8.6

**Note:** Clinical practice includes the use of a screening 50g glucose load (fasting not required). If the one hour value is  $\geq 140$  mg/dL ( $\geq 7.8$  mmol/L), proceed to a diagnostic OGTT.

The alternative is the single step approach using the diagnostic GTT.

**Two or more of venous plasma concentrations must be met or exceeded for a positive diagnosis.**

## REFERRAL

All cases of GDM should be referred to a specialist centre for care and delivery.

## POST-PARTUM FOLLOW UP

Although most women with gestational diabetes mellitus revert to normal glucose levels after pregnancy, they are at significant risk of developing GDM in subsequent pregnancies as well as Type 2 Diabetes later in life. Intense lifestyle modification should be encouraged with annual routine screening for diabetes starting at the 6 week post-partum visit.

## **SECTION VI**

### **EFFECTIVE SELF CARE THROUGH EDUCATION**

“Helping people with diabetes to acquire the knowledge and skills to manage their own condition is central to their leading a full and healthy life.”

Diabetes Action Now, 2004

## SELF-MANAGEMENT EDUCATION GOALS

Apply the principles of chronic disease self management (National CDSP)

The following goals are a guide for the entire health care team which should work together to achieve them.

***Always remember that the main member of the team is the PERSON LIVING WITH DIABETES and that he/she should be totally involved in goal and priority setting***

- Describing the disease process and treatment options
  - Identify diabetes as a disorder in which the body is unable to utilise food properly
  - Describe the actions of insulin and what happens in the body when insulin is not available or does not work properly
  - Explain how the prescribed meal and exercise plan and blood glucose monitoring are essential for management of the disease
  - List the risk factors for diabetes
  - State how the diagnosis of diabetes is established
  - State the importance and benefits of good diabetes control
  - Describe the effects of oral hypoglycaemic agents
- Incorporating appropriate nutritional management
  - State that nutrition therapy and meal planning are essential components in the control of blood glucose
  - List the goals:
    - Identifying appropriate body weight (explain BMI)
    - Importance of reaching and maintaining appropriate body weight
    - Controlling blood glucose and lipids
    - Practising good nutrition
  - Discuss types of nutrients that affect blood glucose and lipid levels
  - List the types and amounts of foods to include in meals as indicated in the meal plan
  - State the relationship of food and meals to blood glucose levels, medication and activity
  - Discuss meal-planning strategies to meet the goals
  - Demonstrate the correct portion sizes for the meal plan
  - Identify times for snacks
  - Demonstrate how to evaluate food products using food labels
  - Discuss use of non-caloric sweeteners
  - Explain importance of reducing total fat as well as saturated and hydrogenated fats
  - State the relationship of salt and hypertension
    - Discuss ways to reduce salt
  - State the effect of alcohol on blood glucose
  - Describe how to prevent and manage hypoglycaemic attacks
  - State the relationship between obesity and diabetes and the benefits of weight loss

- Incorporating physical activity into lifestyle
  - State that exercise is recommended for diabetes management and good health in general
  - State that exercise can help lower blood glucose levels
  - Describe role of physical activity on a regular basis to achieve or maintain appropriate body weight
  - State the need to consult with the health care team before beginning an exercise program
  - List types of physical activity that the patient agrees to use
  - Describe the proper shoes and clothing to use
  - State why and how to avoid dehydration
  - State that hypoglycaemia can result from exercise if certain medications are used
    - State relationship of exercise to oral agent activity
      - ✓ Timing of meals and exercise
    - List factors that may increase the risk of exercise-induced hypoglycaemia
      - ✓ Alcohol and  $\beta$ -blockers
  
- Using medications for therapeutic effectiveness
  - State that in addition to diet and exercise some individuals may need either oral agents or insulin
  - State that the oral medication dosage is individualised
  - State the action of oral medication on blood glucose level
  - State the name of oral medication, its dosage and when it is to be taken
  - List the possible side effects of oral medication
  - State the possible interactions of diabetes medications with other medications taken
  
- Monitoring
  - Describe rationale for monitoring blood glucose
  - Demonstrate how to perform tests with appropriate materials
  - Demonstrate how to record results
  - Demonstrate proper disposal of lancets and other materials
  - State when and how to contact health care provider if results are consistently higher or lower than guidelines given
  
- Preventing, detecting and treating chronic complications
  - Identify chronic complications associated with diabetes
  - State that near-normal blood glucose may prevent or delay chronic complications
  - State that smoking increases risk of complications
  - State the need for an eye examination on a regular basis
  - State that diabetes can affect the eyes without any symptoms being initially apparent
  - State the need for daily foot inspection and for wearing well fitting shoes
  - Demonstrate how to bathe feet and trim toenails safely

- Identify factors that may cause injury to the feet
- State the need to report early symptoms of potentially serious problems
- State the need for daily dental and mouth care
- Identify the organ systems particularly at risk from diabetes
- State that regular blood pressure monitoring is necessary
  - Need to control high blood pressure
- State that monitoring of cholesterol and triglycerides is necessary
  - State differences between HDL-C and LDL-C
- State that diabetes may cause sexual dysfunction and identify resources for help

## **SECTION VII**

### **MANAGEMENT OF CHILDREN**

## MANAGEMENT OF CHILDREN

*These are general guidelines to inform Primary Care users of the protocol; extracted from:*

### **Care of Children and Adolescents With Type 1 Diabetes - A statement of the American Diabetes Association 2004.**

Children with Diabetes should be managed by a Paediatrician usually in conjunction with a Paediatric Endocrinologist.

#### **Criteria for the Diagnosis**

1. Symptoms of diabetes and a casual plasma glucose  $\geq 200$  mg/dl (11.1 mmol/l). Casual is defined as any time of day without regard to time since last meal. The classic symptoms of diabetes include polyuria, polydipsia, and unexplained weight loss.  
**OR**
2. Fasting plasma glucose  $\geq 126$  mg/dl (7.0 mmol/l). Fasting is defined as no caloric intake for at least 8 h.  
**OR**
3. 2-h plasma glucose  $\geq 200$  mg/dl (11.1 mmol/l) during an oral glucose tolerance test. The test should be performed as described by the World Health Organization, using a glucose load of 75 g anhydrous glucose dissolved in water or 1.75 g/kg body wt if weight is  $< 40$  pounds (18 kg).

In the absence of unequivocal hyperglycemia, confirm by repeat testing on a different day. The oral glucose tolerance test is not recommended for routine clinical use, but may be required in the evaluation of patients when diabetes is still suspected despite a normal fasting plasma glucose.

**Screening** - indicated only in children/youth at substantial risk (as with screening recommendations for adults). American Diabetes Association consensus statement titled "Type 2 Diabetes in Children and Adolescents" recommends that overweight (defined as BMI  $> 85$ th

percentile for age and sex, weight for height >85th percentile, or weight >120% of ideal [50th percentile] for height) youths with any two of the risk factors listed below be screened. Testing should be done every 2 years starting at age 10 years or at the onset of puberty if it occurs at a younger age. Testing may be considered in other high-risk patients who display any of the following characteristics:

- Have a family history of type 2 diabetes in first- and second-degree relatives;
- Belong to a certain race/ethnic group (Native Americans, African-Americans, Hispanic Americans, Asians/South Pacific Islanders);
- Have signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, polycystic ovary syndrome).

### **Components of the Initial Visit**

#### **Medical history**

- Symptoms, and results of laboratory tests related to the diagnosis of diabetes
- Recent or current infections or illnesses
- Previous growth records, including growth chart, and pubertal development
- Family history of diabetes, diabetes complications, and other endocrine disorders
- Current or recent use of medications that may affect blood glucose levels (e.g., glucocorticoids, chemotherapeutic agents, atypical antipsychotics, etc.)
- History and treatment of other conditions, including endocrine and eating disorders, and diseases known to cause secondary diabetes (e.g., cystic fibrosis)
- Lifestyle, cultural, psychosocial, educational, and economic factors that might influence the management of diabetes
- Use of tobacco, alcohol, and/or recreational drugs
- Physical activity and exercise
- Contraception and sexual activity (if applicable)
- Risk factors for atherosclerosis: smoking, hypertension, obesity, dyslipidemia, and family history
- Review of Systems (ROS) should include gastrointestinal function (including symptoms of celiac disease) and symptoms of other endocrine disorders (especially hypothyroidism and Addison's disease)
  - Prior Hb A1C records\*
    - Details of previous treatment programs, including nutrition and diabetes self-management education, attitudes, and health beliefs\*
  - Results of past testing for chronic diabetes complications, including ophthalmologic examination and microalbumin screening\*
  - Frequency, severity, and cause of acute complications such as ketoacidosis and hypoglycemia\*
  - Current treatment of diabetes, including medications, meal plan, and results of glucose monitoring and patients' use of data\*

#### **Physical examination**

- Height, weight, and BMI calculation (and comparison to age and sex-specific norms)
- Blood pressure determination and comparison to age-, sex-, and height-related norms
- Funduscopic examination

- Oral examination
- Thyroid palpation
- Cardiac examination
- Abdominal examination (e.g., for hepatomegaly)
- Staging of sexual maturation
- Evaluation of pulses
- Hand/finger examination
- Foot examination
- Skin examination (for acanthosis nigricans SMBG testing sites and insulin-injection sites\*)
- Neurological examination

**Laboratory evaluation**

- *If clinical DKA:* Serum glucose, electrolytes, arterial/venous pH, serum/urine ketones
- *If signs and symptoms suggestive of type 2 diabetes:*
- Evidence of islet autoimmunity (e.g., islet cell [ICA] 512 or IA-2, GAD, and insulin autoantibodies)
- Evidence of  $\beta$ -cell secretory capacity (e.g., C-peptide levels) after 1 year, if diagnosis in doubt
- HBA1C
- Lipid profile
- Thyroid-stimulating hormone (TSH) levels
- Celiac antibodies at diagnosis or initial visit if not done previously

**Referrals and screening**

- Yearly ophthalmologic evaluation.
- Medical nutrition therapy (by a registered dietitian)-As part of initial team education and on referral, as needed; a series of sessions over the initial 3 months after diagnosis, then at least annually, with young children requiring more frequent reevaluations
- Diabetes educator - As part of initial team education, or referral as needed at diagnosis; a series of sessions during the initial 3 months of diagnosis, then at least annual reeducation

**Plasma Blood Glucose and A1C Goals for Type 1 Diabetes by Age Group**

Values by age	Plasma blood glucose goal range (mg/dl)		A1C	Rationale
	Before meals	Bedtime/overnight		
Toddlers and preschoolers (<6 years)	100-180	110-200	<8.5 (but >7.5) %	<ul style="list-style-type: none"> <li>• High risk and vulnerability to hypoglycemia</li> <li>• Risks of hypoglycemia and relatively low risk of complications prior to puberty</li> </ul>
School age (6-12 years)	90-180	100-180	<8%	<ul style="list-style-type: none"> <li>• Risk of hypoglycemia</li> </ul>
Adolescents and young adults (13-	90-130	90-150	<7.5%*	<ul style="list-style-type: none"> <li>• Developmental and psychological issues</li> </ul>

19 years)				
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Key concepts in setting glycemic goals:

- Goals should be individualized and lower goals may be reasonable based on benefit-risk assessment
- Blood glucose goals should be higher than those listed above in children with frequent hypoglycemia or hypoglycemia unawareness
- Postprandial blood glucose values should be measured when there is a disparity between preprandial blood glucose values and A1C levels

\* A lower goal (<7.0%) is reasonable if it can be achieved without excessive hypoglycemia

## Insulin Management

Insulins used in children are **rapid-acting insulin analogs, short-acting insulin, intermediate-acting insulin (NPH and Lente), and long-acting insulin analogs**. These insulins are used in combination or individually and are delivered by **syringe** or, in some cases, **a pen or pump**.

Although there is no one established formula for determining a child's insulin requirement, **insulin requirements are usually based on body weight, age, and pubertal status**. Children with newly diagnosed type 1 diabetes usually require an **initial total daily dose of ~0.5-1.0 units/kg**. In general, younger, prepubertal children require lower doses while ketoacidosis, use of steroids, and the hormonal changes of puberty all dictate higher doses. The small insulin needs of infants and toddlers may require diluted insulin to allow for more precise dosing and measurement of insulin in <1-unit increments (Diluents are available for specific types of insulins from the insulin manufacturers. Insulin can be diluted either at a pharmacy or at home once parent training has been completed) Insulin pens that deliver insulin in 0.5-unit increments also are available.

A newly diagnosed child may enter a **honeymoon phase** (increased insulin production within weeks of starting of insulin Rx) with insulin requirements falling well below the initial 0.5-1.0 units/kg per day needed to maintain blood glucose targets. But  $\beta$ -cell destruction continues during this honeymoon phase, and with the progressive loss of  $\beta$ -cell function, there is progressive need for increased exogenous insulin. Insulin requirements increase with growth and, in particular, during puberty may increase to as much as 1.5 units/kg per day due to hormonal influences (growth hormone; sex hormones)

Children with diabetes often require **multiple daily injections of insulin**, using combinations of rapid-, short-, intermediate-, or long-acting insulin before meals and at bedtime to maintain optimal blood glucose control. If a large snack is consumed between meals, as often occurs in adolescents in the late afternoon, an extra injection of a rapid-acting insulin may be necessary. The majority of children with diabetes are treated with **2 or 3 doses of rapid-acting or short-acting insulin combined with intermediate-acting insulin**.

However, many patients require more frequent insulin doses to achieve and maintain good control, especially after the honeymoon period is over. E.g: **The basal/bolus insulin regimen** uses a **long-acting insulin analog (glargine) combined with a rapid-acting insulin analog given before meals and snacks** and has been documented to result in stable control and less

hypoglycemia compared with regimens using intermediate and short insulin regimens. Because many young children and teenagers may consume multiple snacks throughout the day, **an ideal basal/bolus regimen may consist of as many as six to seven insulin injections per day.**

Insulin pump use is increasing rapidly in the pediatric population. There is no best predetermined age to initiate insulin pump therapy. As with all diabetes management issues, individualized treatment plans that consider the needs of the patient as well as those of the family are best. Adult support at both home and school is essential for success with all diabetes management but especially with pump treatment until the child is able to manage the diabetes independently

### **Recommendations**

- Insulin requirements are usually based on body weight, age, and pubertal status.
- A basal-bolus insulin regimen using either an MDI regimen or an insulin pump should be considered.

### **Blood Glucose Monitoring**

See ADA consensus statement "Self-Monitoring of Blood Glucose": For children with type 1 diabetes, four or more tests per day are generally necessary to determine patterns of hypoglycemia and hyperglycemia and to provide data for insulin dose adjustments. Preprandial blood glucose levels are important, but postprandial and overnight levels are also valuable in determining insulin dose adjustments. Special attention should be addressed to the preschool and early school-aged child who may be unable to identify and self-report episodes of hypoglycemia. Safe management of these children requires more frequent blood glucose testing. Monitoring at anticipated peaks in insulin action may be necessary, particularly if a child has not eaten well at the preceding meal. Additional testing during periods of increased physical activity is also very important.

### **Recommendations**

- Use glucose levels to make insulin dose adjustments acutely for rapid- or short-acting insulins and after observing patterns over several days to adjust doses of long-acting insulins
- Use insulin-to-carbohydrate ratios and correction doses for high & low blood glucose levels
- Test at least four times a day
- Periodically test postprandial, before- and after-exercise, and nocturnal glucose levels

**DKA** - a potentially life-threatening consequence of absolute or relative insulin deficiency resulting in hyperglycemia and an accumulation of ketone bodies in the blood, with subsequent

metabolic acidosis; generally categorized by the severity of the acidosis:

- ✓ mild DKA - venous pH <7.3 and bicarbonate <15 mmol/l
- ✓ moderate DKA - pH <7.2 with a bicarbonate <10
- ✓ severe DKA - pH <7.1 and bicarbonate <5. .

DKA may occur in a variety of circumstances:

**DKA at Diagnosis.** Approximately 30% of new-onset patients present in ketoacidosis; increases with decreasing age of the child (<4 years of age), lower socioeconomic status, and children from families who are not familiar with the signs and symptoms of diabetes (i.e., those without a first-degree relative with type 1 diabetes).

**DKA After Diagnosis.** In a child with known diabetes, the most common cause is omitted insulin injections. Intercurrent illnesses, trauma, surgery, or other causes of physiologic stress may result in DKA if adequate insulin dose adjustments are not made. Emotional stress may be a clue to insulin omission.

Children are at higher risk for developing cerebral edema during treatment. Cerebral edema is an important cause of DKA-associated deaths in childhood and for 20% of all deaths in children with diabetes <20 years of age. While cerebral edema has been reported in individuals in the fourth decade of life, it is most common in patients <15 years old who are severely dehydrated, acidotic, and hyperosmolar. Newly diagnosed patients <5 years of age seem to be at the greatest risk.

**Recurrent DKA.** is almost always due to insulin omission. A child or adolescent with recurrent episodes of ketoacidosis needs special attention. These children have a higher incidence of psychiatric illness, especially depression. Psychological counseling is recommended for all children with recurrent DKA and their families.

Because of the significant mortality and morbidity associated with DKA, prevention is of paramount importance. Prevention can be achieved by:

- Public awareness of the signs and symptoms of untreated diabetes
- Education of friends, roommates, and other caregivers about the signs and symptoms of early DKA
- Increased recognition that insulin omission due to psychological problems and lack of financial resources is the most common cause of DKA in patients with established diabetes
- Improved detection of families at risk
- Education about ketone monitoring

- 24-h telephone availability and encouragement to contact the healthcare team when blood glucose levels are high, when there is ketonuria or ketonemia, and especially during intercurrent illness.

## **Recommendations**

### 1. Monitoring

- Hourly heart rate, respiratory rate, blood pressure, and neurologic status
- Hourly accurate fluid input and output
- Electrocardiogram monitoring for assessment of T-waves for evidence of hyperkalemia/hypokalemia
- Hourly capillary glucose
- Laboratory tests: electrolytes, blood glucose, and blood gases should be repeated every 2-4 h.

### 2. Fluids and electrolytes

- Intravenous fluids should be given to replace fluid deficits over 48 h
- Hypotonic fluids (<0.45N NaCl) should never be given as initial therapy
- Potassium levels should be monitored closely and replaced as soon as urine output is established.

### 3. Insulin replacement

- Initial insulin therapy should be given intravenously in a dose of  $0.1 \text{ unit} \cdot \text{kg}^{-1} \cdot \text{h}^{-1}$

### 4. A flow sheet should be maintained documenting clinical observations, intravenous and oral fluids, insulin dosing, and laboratory results

## REFERENCES

- ACE Consensus Development Conference on Guidelines for Glycemic Control. *Endocr Pract. Suppl.* Nov/Dec 2001.
- American Diabetes Association. Consensus Development Conference on Insulin Resistance. 5-6 November 1997. *Diabetes Care.* 1998;21:310-314.
- American Diabetes Association. 2004; Volume 27(Supplement 1): Clinical Practice Recommendations
- American Diabetes Association 2005; Volume 28 (Supplement 4): Clinical Practice Recommendations
- Black HR, Cohen JD, Kaplan NM, et al. The sixth report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Arch Intern Med.* 1997;157:2413-2445.
- Caribbean Food and Nutrition Institute. Protocol for the Nutritional Management of Obesity, Diabetes and Hypertension in the Caribbean. PAHO/WHO Office of Caribbean Program Coordination; Barbados, 2004.
- Caribbean Health Research Council. Managing Hypertension in Primary Care in the Caribbean. CHRC; St. Augustine, Trinidad and Tobago, 2005.
- Colwell JA. Aspirin therapy in diabetes. *Diabetes Care.* 1997;20:1767-1771.
- Cooper RS, Rotimi CN, Kaufman JS, et al. Prevalence of NIDDM among populations of the African Diaspora. *Diabetes Care.* 1997;20(3):343-348.
- Delahanty LM, Halford BN. The role of diet in behaviors in achieving improved glycemic control in intensively treated patients in the Diabetes Control and Complications Trial. *Diabetes Care.* 1993;16:1453-1458.
- Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N Engl J Med.* 1993;329:977-986.
- Diabetes Guidelines Task Force. AACE guidelines for the management of diabetes mellitus. *Endocr Pract.* 1995; 1:149-157.
- Eastman RC, Javitt JC, Herman WH, et al. Model of complications of NIDDM. II. Analysis of the health benefits and cost-effectiveness of treating NIDDM with the goal of normoglycemia. *Diabetes Care.* 1997;20:735-744.
- Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Third report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). National Institutes of Health, National Heart Lung and

Blood Institute. *NIH Publication* No. 01-3670 (2001).

Hellman R. A new approach in intensive therapy for type 2 diabetes. *Practical Diabetology*. 1998;17:21-26.

Hennis A, Wu S-Y, Nemesure B, Li X, Leske MC, for the Barbados Eye Studies Group. Diabetes in a Caribbean population: epidemiologic profile and implications. *Int J Epidemiol* 2002;31:234-239.

Hennis A, Fraser HS, Jonnalagadda R, Fuller J, Chaturvedi N. Explanations for the high risk of diabetes-related amputation in a Caribbean population of Black African descent, and potential for prevention. *Diabetes Care* 2004;27:2636-41.

Herman WH, Eastman RC. The effects of treatment on the direct costs of diabetes. *Diabetes Care*. 1998;21(Suppl 3):C19-C24.

Holder Y, Lewis M. Epidemiological overview of morbidity and mortality. In: Pan American Health Organization. Health Conditions in the Caribbean. *Scientific Publication* No. 561. Pp 22–61. PAHO Washington DC. 1997.

Kissebah AH. Central obesity: measurement and metabolic effects. *Diabetes Rev*. 1997;5:8-20

Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, Nathan DM; Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med*. 2002 Feb 7;346(6):393-403.

Ramdath DD, Issacs RL, Teelucksingh S, Wolever TM. Glycaemic index of selected staples commonly eaten in the Caribbean and the effects of boiling v. crushing. *Br J Nutr* 2004; 91:971-7.

UK Prospective Diabetes Study (UKPDS) Group. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). *Lancet*. 1998;352:837-853.

UK Prospective Diabetes Study (UKPDS) Group. Effect of intensive blood-glucose control with metformin on complications in overweight patients with type 2 diabetes (UKPDS 34) [published erratum appears in *Lancet*. 1998;352:1557]. *Lancet*. 1998;352:854-865.

UK Prospective Diabetes Study Group. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38 [published erratum appears in *BMJ*. 1999;318:29]. *BMJ*. 1998; 317:703-713.

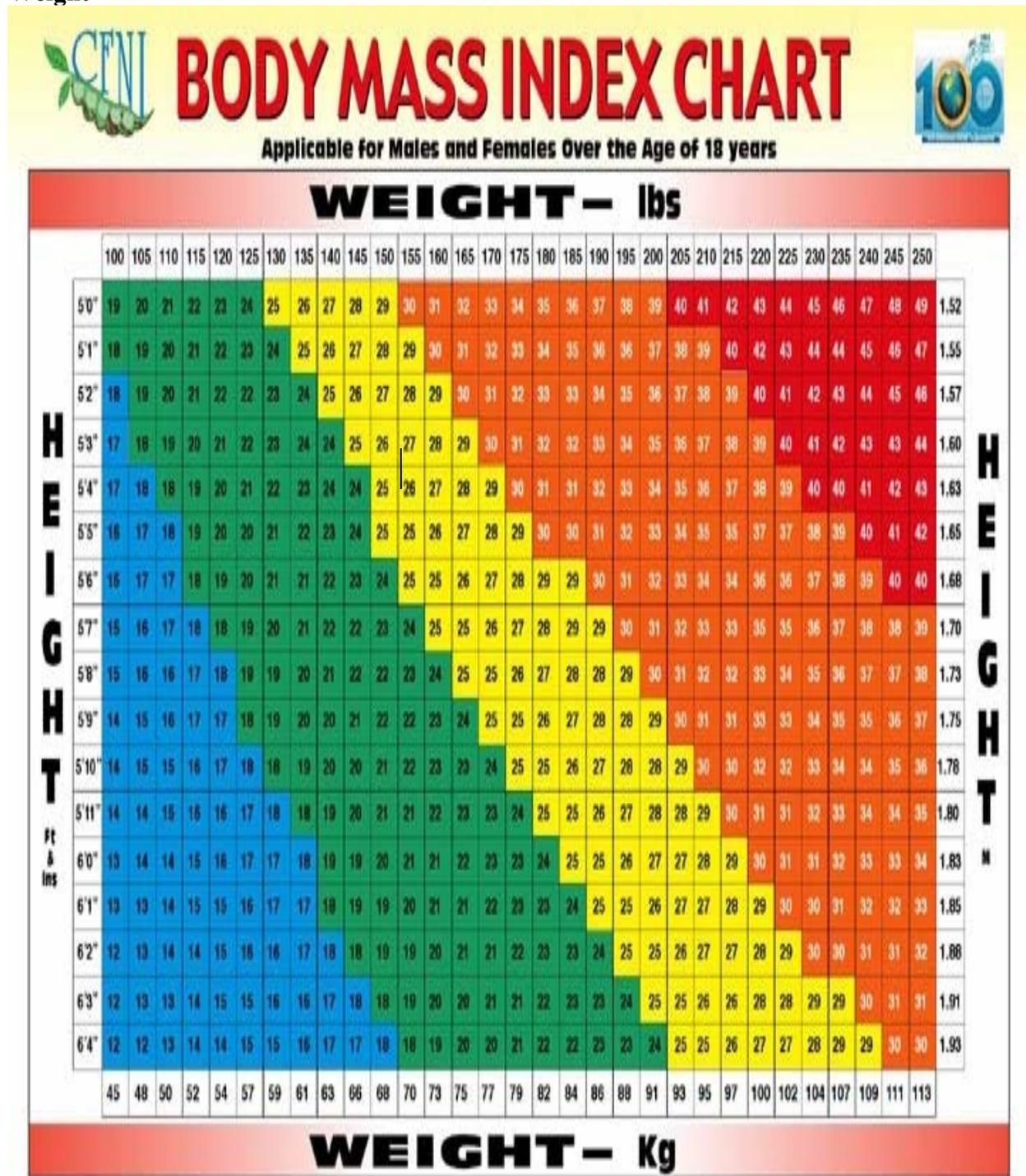
Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care*. 2004 ;27:1047-53.

Wilks R, Rotimi C, Bennett F, et al. Diabetes in the Caribbean: results of a population survey from Spanish Town, Jamaica. *Diabetic Medicine* 1999;16:875-883

## **ABBREVIATIONS**

ACE Inhibitor	Angiotensin-converting Enzyme Inhibitor
BMI	Body Mass Index
FPG	Fasting Plasma Glucose
GDM	Gestational Diabetes Mellitus
HbA1c	Glycated (or glycosylated) Haemoglobin
HDL cholesterol	High Density Lipoprotein cholesterol
IFG	Impaired Fasting Glucose
IGT	Impaired Glucose Tolerance
LDL cholesterol	Low Density Lipoprotein cholesterol
NPH	Neutral Protamine Hagedorn
OGTT	Oral Glucose Tolerance Test
SMBG	Self Monitoring of Blood Glucose
TG	Triglycerides
UKPDS	UK Prospective Diabetes Study
VLDL cholesterol	Very Low Density Lipoprotein cholesterol

**Appendix 1 Body Mass Index (BMI) Chart for Identifying Target Weight**



Produced by the Caribbean Food & Nutrition Institute - A Specialized Centre of the Pan American Health Organization/ World Health Organization - 2002

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## Body Mass Index classification

BMI	Weight/height <sup>2</sup> (kg/m <sup>2</sup> )
Normal	18.5 -24.9
Overweight	25 -29.9
Obese	30 – 39.9
Morbidly obese	above 40

### How to use the BMI Charts

1. Take the weight of the client (ensure that this is accurately taken) and record it.
2. Take the height of the client (ensure that this is accurately taken) and record it.
3. On the BMI chart use the top or bottom column headings (top heading shows weight in pounds and bottom shows weight in kilos) to find the weight measured.
4. On the BMI chart use the left or right row headings (left margin shows height in feet and inches and right shows height in meters) to find the height measured.
5. Using the weight and the height identified, see where the weight column and height row meet. This will give you the Body Mass Index (BMI) of the person measured.
6. Using the guide at the bottom of the BMI Chart, check the colour of the square to identify the classification of the client.

Example 1:

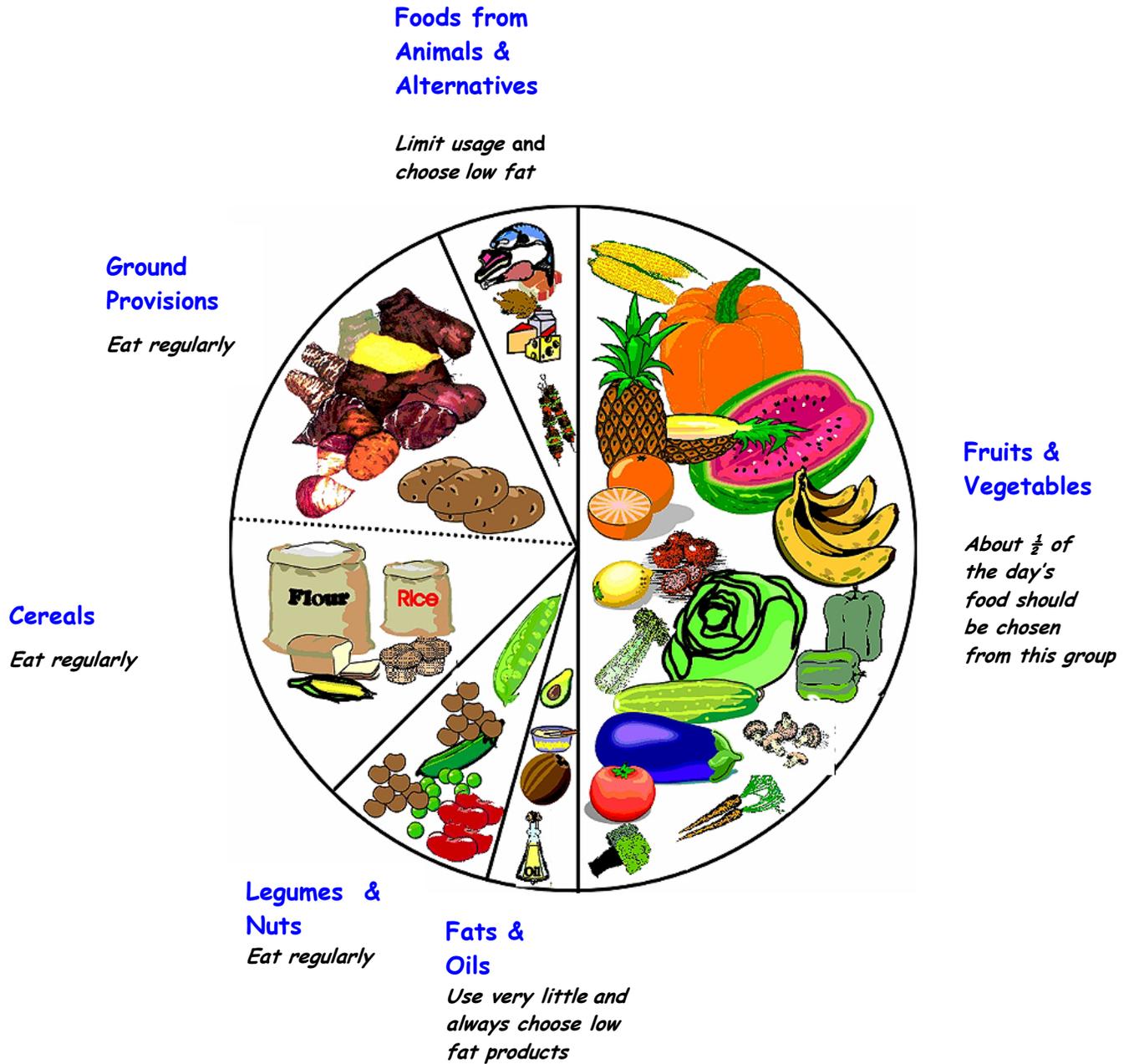
1. Person's weight is 190 lbs (86 kg)
2. Person's height is 5ft 9 inches (1.75 m)
3. The number in the box where the weight column and height row intersect is 28.
4. BMI is 28 and colour of box is yellow, which is classified as Overweight.

Feet & Inches	lbs				
	180	185	190	195	200
5'7"					
5'8"					
5'9"			28		
5'10"					
5'11"					

Appendix II Recommended Composition of Healthy Diets

**A healthy diet?**

If all the foods you eat each day were arranged on one large plate, the amounts should look like this:



Developed by: Dan Ramdath with the Assistance of Debra Ramdath and Troy Jennings

**Appendix III: Diabetes Management Flow Sheet**

Name \_\_\_\_\_

Date of Birth \_\_\_\_\_

Height \_\_\_\_\_

Target body weight \_\_\_\_\_

Sex

M	F
---	---

**CHECK EVERY VISIT**

Date							
Weight/BMI							
Home monitoring results							
Blood glucose							
Blood pressure							
Dietary advice							
Exercise advice							
Foot inspection							
Smoking/alcohol							
Symptoms							
Drug 1							
Drug 2							
Drug 3							
Drug 4							
Drug 5							
Adherence with treatment							
State of injection sites for insulin treatment							

**CHECK AT LEAST ONCE EVERY YEAR**

Date							
Foot pulses							
Foot sensation							
Visual acuity							
Fundoscopy							
Urine protein							
Blood urea/creatinine							
Cholesterol							
- HDL-C							
- LDL-C							

- Triglycerides							
HbA1c (preferably every 3-6 months)							
Waist circumference							
Oral Health							
Mental Health							
ECG							
Smoking							
Alcohol							
Other							

## Appendix IV Sick Day Rules

When a person on insulin has a cold, the flu, a stomach upset, sore throat, urinary tract infection, chest infection or other illnesses of short duration, the blood glucose might increase. The following rules should be followed to ensure that blood glucose levels remain well controlled.

- Continue SMBG

Illness or infection can result in an increase in the amount of insulin that the body needs and cause an increase in blood glucose. Home monitoring of blood glucose is recommended

- Test urine for Ketones

This is also important to ensure that the blood glucose and insulin levels are appropriate

- Continue with Insulin

Clients should be told **never to stop** taking insulin. They may require less insulin if their appetite is poor but as illness usually increases the body's demand for insulin the regular dose should not be stopped.

- Review dietary needs

Since illness is often accompanied by decreased appetite, the diet and meal plan may need to be revisited and substitute foods used which are more easily digested. More frequent, smaller meals may be better tolerated. The exchange lists should be used to determine appropriate food substitutes.

- Maintain contact with the health care team

Clients should be made aware that they should contact the health care team if:

- They are vomiting
- They have ketones in their urine
- Their blood sugar is consistently higher than usual
- They are unable to eat and/or drink
- They have a fever
- They have diarrhoea and/or nausea persisting for more than 24 hours
- They have abdominal pain
- They are not sure what to do!

**NOTE:**

*Those clients who are taking oral hypoglycaemic agents should also communicate with the health care team if they have fever, diarrhoea, infection or vomiting as the oral agent they are using may not be appropriate in dose or type.*

## **Appendix V Care of the Foot in Persons with Diabetes**

### **Patients should be advised to:**

- Perform daily examination of feet using mirrors to observe sole of feet or with the assistance of a relative
- Never walk barefooted indoors or outdoors
- Never cut corns, bunions nor use corn pads
- Avoid corn cures, paints or plasters
- Seek assistance with cutting of nails
- Wear comfortable, loose fitting shoes
- Avoid open sandals. Use sandals with good protection of the feet.
- Keep feet clean and dry
- Cover any minor cuts
- Never use iodine on the foot
- Never prick blisters

### **Comfortable Shoes**

Diabetics often cannot tell if a shoe is uncomfortable because feet may be insensitive due to neuropathy. Therefore, advise as follows:

- Ensure that they have enough time to purchase shoes. Purchase shoes in the afternoon
- Look at shoe and compare to shape of their feet. They should be similar
- There should be a deep toe box to allow the toes to function and correct width to accommodate the widest part of the foot. Shoe size should allow 1 inch of space between tips of toes and front of shoe.
- Shoe should have an effective fastening e.g. lace, strap or velcro.
- Leather uppers are preferable.
- The seamless styled shoe uppers are better; and a thick, soft and comfortable cushioning sole that aids with shock absorption and reduces the probability of being punctured through the shoe.
- Spend a few minutes walking in the shoes to ensure that they are comfortable

### **Consult doctor/podiatrist/chiropractist if there is:**

- Colour change in any part of the foot or leg
- Discharge coming from break in skin
- Any pain, throbbing, swelling or itching