

**Clinical Practice Guidelines**  
**On**  
**Management of**  
**Obesity**  
**2003**

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## 1. INTRODUCTION

The global burden of overweight (BMI=25.0) and obesity (BMI=30.0) is estimated at more than 1.1 billion. There is evidence that the risk of obesity related diseases among Asian rises from a lower BMI of 23 (1). If this were adopted as a new benchmark for overweight Asians, it would require a major revision of approaches in the Asian sub-regions, where a significant proportion of the 3.6 billion populations already has a mean BMI of 23.4. In Malaysia, the National Health and Morbidity Survey 1996 reported that in adult males, 15.1% were overweight and 2.9% obese while in adult females, 17.9% were overweight and 5.7% obese (2). It was also reported that there was little difference between rural and urban populations and that there were more obese Malays and Indians as compared to Chinese. In male adolescents, a study carried out in the same 4 schools in 1990 and 1997 reported an increase in prevalence of obesity from 1% to 6%.

The co morbidities of obesity produce financial costs to the health economy of many developed countries. Similar demands in Malaysia will impose a huge burden on the human and economic resources and are liable to disturb priorities in the health care or other sectors (3). As Malaysia proceeds rapidly towards developed economy status, there is a need to develop a national strategy to tackle both dietary and activity contributors to the excess weight gain of the population (4)

The objective of this Clinical Practice Guidelines is to assist healthcare providers to better diagnose and manage obese patients. Treatment strategies have been graded based on the levels of evidence using the system outlined below (MOH):

- A. At least one meta analysis, systematic review, or randomized controlled trial, or evidence rated as good and directly applicable to the target population
- B. Evidence from well conducted clinical trials, directly applicable to the target population, and demonstrating overall consistency of results; or evidence extrapolated from meta analysis, systematic review, or RCT
- C. Evidence from expert committee reports, or opinions and/or clinical experiences of respected authorities; indicates absence of directly applicable clinical studies of good quality

## 2. Definition of Obesity

### 2.1. Body Mass Index (BMI)

This is the most established and widely used measurement and is defined as:

$$\text{BMI} = \text{Weight (kg)}/\text{Height}^2 \text{ (m)}^2$$

The current WHO classification states that the cut-off points for overweight and obesity is 25 and 30 kg/m<sup>2</sup> respectively (5). However, it has become increasingly clear that there is a high prevalence of type 2 diabetes mellitus and cardiovascular risk factors in parts of Asia below those cut-off points. Evidence from several Asian countries are now available including Hong Kong (6), Singapore (7), China (8-10), India (11, 12), and Japan (13) to show that the risk of co morbidities begin to rise at lower BMI values. Many Asian populations have a higher body fat percent at similar BMI, compared with Caucasian/European populations (14-17). Thus, based on current evidence, the following classification of weight by BMI according to risk of co-morbidities is recommended.

**Table 2.1 : Classification of weight by BMI (Evidence Level C)**

Classification	BMI (kg/m <sup>2</sup> )	Risk of co-morbidities
Underweight	<18.5	Low (but increased risk of other clinical problems)
Normal range	18.5 – 22.9	Average
Overweight:	≥ 23	
Pre-obese	23.0 – 27.4	Increased
Obese I	27.5 – 34.9	Moderate
Obese II	35.0 – 39.9	Severe
Obese III	≥ 40.0	Very severe

## **2.2. Waist circumference (WC)**

Waist Circumference (WC) measurement is simple, reliable, and correlates well with abdominal fat content irrespective of the BMI. WC is also an independent risk factor for cardiovascular diseases. It is most useful in individuals who are in the normal and overweight categories of the BMI. In those with BMI > 35 kg/m<sup>2</sup> it is unnecessary to measure WC as it loses its predictive value.

The current WHO recommendations (5) suggest that the WC of 94 cm and 80 cm is associated with an increased risk in man and woman respectively. However, it has become increasingly clear that there is a high prevalence of type 2 diabetes melitus and cardiovascular risk factors in parts of Asia below those cut-off points. Evidence from several Asian countries are now available including Hong Kong (6), Singapore (7) and China (8-10). Thus, based on current evidence, the following waist circumference is associated with an increased risk (Evidence Level C):

- *Men* <sup>3</sup> 85 cm
- *Women* <sup>3</sup> 80 cm

## **3. COMPLICATIONS OF OBESITY**

### **3.1. Overall Mortality**

Excessive weight is associated with increased risk of death. The relationship was maintained even after adjustment for other risk factors. The risk progressively increases with higher BMI (18).

### **3.2. Overall Morbidity**

There are a variety of conditions associated with obesity as shown in Table 3.1.

**Table 3.1 : Health risks associated with obesity<sup>1</sup> (Evidence Level B)**

<b>Greatly increased (RR&gt;3)</b>	<b>Moderately increased (RR 2-3)</b>	<b>Mildly increased (RR 1-2)</b>
Type 2 diabetes mellitus  Hepatobiliary disease (Gallstone <sup>2</sup> and Steatosis <sup>3</sup> ) Dyslipidaemia Metabolic syndrome <sup>4</sup>  Breathlessness <sup>5</sup> Sleep apnoea <sup>6</sup>	Coronary heart disease  Cerebrovascular Disease  Cardiac failure Left Ventricular Hypertrophy <sup>7</sup>  Hypertension Osteoarthritis (knees and hips) Hyperuricaemia and Gout	Cancer (breast endometrial colo- rectal, liver, prostate, gallbladder) Reproductive hormone abnormalities  Polycystic ovarian syndrome Impaired fertility (Anovulation, reduced testosterone levels) <sup>8</sup> Low back pain Increased anaesthetic risk Foetal defects associated with maternal obesity

**RR** = Relative Risks

(Modified from (5))

**Notes :**

1. The risk of cardiovascular disease and its risk factors is greatest in patients with abdominal obesity
2. The increased cholesterol turnover (linearly related to body fat) may account for increased risk of gall stone in obese individuals.
3. Steatosis (fatty liver) is common due to deposition of triglycerides in hepatocytes.
4. Metabolic syndrome is defined as Glucose intolerance (IGT, IFG or diabetes mellitus) or insulin resistance, together with 2 or more of other components listed below (19) :-
  - a. Impaired glucose tolerance (IGT) or diabetes
  - b. Insulin resistance (under hyperinsulinaemic euglycaemic conditions, glucose uptake below lowest quartile for background populations under investigation)
  - c. Raised arterial pressure  $\geq 140/90$  mmHg
  - d. Raised plasma triglycerides  $\geq 1.7$  mmol/L and / or low HDL-C  $< 0.9$  mmol/L (men);  $< 1.0$  mmol/L (women)
  - e. Central obesity (Waist Hip Ratio : Men  $> 0.9$ , Women  $> 0.85$ ) and / or BMI  $> 30$  kg/m<sup>2</sup>
  - f. Microalbuminuria (Urinary albumin excretion  $\geq 20$   $\mu$ g/min or albumin creatinine ratio of  $\geq 30$  mg/g of creatinine)
5. Breathlessness is due to decrease in residual lung volume associated with increased abdominal pressure on the diaphragm.
6. Sleep apnoea, is due to increased neck circumference and fat deposits in the pharyngeal area.
7. Obesity is associated with eccentric ventricular hypertrophy which causes systolic and diastolic left ventricular dysfunction.
8. Obesity is often associated with anovulation cycles resulting in reduced fertility potential while in men it is associated with decreased testosterone level.

## 4. ADVANTAGES OF WEIGHT LOSS

Weight loss has advantages in reducing cardiovascular risk factors and other obesity associated diseases.

**Table 4.1 Benefits of weight loss on health risks in obesity (Evidence Level B)**

Health Risk	Benefits of 10 kg weight loss in a 100 kg subject
1. Blood Pressure	<ul style="list-style-type: none"><li>• 10 mmHg reduction systolic BP</li><li>• 20 mmHg reduction diastolic BP</li></ul>
	N.B.
	<ul style="list-style-type: none"><li>• Weight loss also reduces the need for medication in hypertensive patients</li></ul>
2. Lipids	<ul style="list-style-type: none"><li>• 10% reduction in Total Cholesterol</li><li>• 15% reduction in LDL-cholesterol</li><li>• 30% reduction in Triglycerides</li><li>• 8% increase in HDL-cholesterol</li></ul>
3. Diabetes	<ul style="list-style-type: none"><li>• &gt;50% reduction in risk of developing DM (Weight loss of 6.8 kg is associated with 58% reduction in incidence of diabetes, at 3 years in the Diabetes Prevention Programme) (20)</li><li>• 30-50% reduction in Fasting plasma glucose</li><li>• 15% reduction in HbA<sub>1c</sub></li></ul>
4. Osteoarthritis	<ul style="list-style-type: none"><li>• Decrease BMI <math>\geq 2\text{kg/m}^2</math> associated with more than 50% decreased risk for developing osteoarthritis (21)</li></ul>
5. Mortality	<ul style="list-style-type: none"><li>• 20 –25% reduction all – cause mortality</li><li>• 30 – 40% reduction diabetes related death</li><li>• 40 – 50% reduction in obesity-related cancer death</li></ul>

(Modified from (22))

## 5. DIAGNOSIS AND ASSESSMENT OF OBESITY IN ADULTS

### 5.1. Diagnosis

The attending doctor should perform a comprehensive medical evaluation. The purpose of the evaluation is to:-

- Assess the degree of obesity
- Determine the associated health risks
- Screen for possible underlying psychological disorders such as depression, substance abuse (See [Appendix 5.1](#))
- Identify possible underlying endocrine, genetic or neurological disorders (See [Section 5.5](#))
- Plan the appropriate weight management strategies

The comprehensive evaluation includes the following:

### **5.1.1. Patient's History**

- Assess eating habits including frequency, food choices, calories, snacking and abnormal eating behaviour (binging, nocturnal eating)
- Assess and categorise patient's habitual physical activities (Refer to Section 6.4 - Physical Activity)
- Family history of obesity, diabetes, hypertension, dyslipidaemia, cardiovascular disease, obesity-related cancer, and thyroid disease.
- Psychological Status Evaluation - Evaluate the state of the patient's self-image, assess mental health, and screen for eating disorder. Refer to a psychiatrist or psychologist if indicated. (See [Appendix 5.1](#)).

### **5.1.2. Physical Examination**

Examination should include:-

- Assessment of degree of obesity and body fat distribution (See Section 5.2)
- Special attention to potential comorbidities especially evidence of metabolic syndrome (See Section 3.2 – Notes 4) and sleep apnoea.
- Use of an appropriate sized cuff to measure the blood pressure. .

### **5.1.3. Laboratory Tests**

The following investigations should be done:-

- Fasting blood glucose (FBG) and Oral Glucose Tolerance Test (if FBG is between 5.5 – 6.9 mmol/L)
- Fasting lipid profile (total cholesterol, HDL-cholesterol, LDL-cholesterol and triglycerides)
- Biochemistry profile (uric acid, renal and liver function tests)

If indicated:

- Thyroid function tests (especially in those above 60 years old)
- Investigations to exclude Polycystic Ovarian Syndrome (PCOS)
- 24 hr urine free cortisol to screen for Cushing's syndrome

## **5.2. Measurement of Obesity and Body Fat Distribution**

### **5.2.1. Body Mass Index (BMI)**

This is the most established and widely used measurement and is defined as:

$$\text{BMI} = \text{Weight (kg)} / \text{Height}^2 \text{ (m)}^2$$

Routine weight measurement is helpful in following the progress of an individual's weight. BMI has its limitations in the estimation in the degree of obesity in the following circumstances:

- Overestimates in very muscular individuals (e.g. athletes).
- Underestimates in individuals who have lost muscle mass (e.g. elderly)
- Exaggerated in individuals with extremes of body height (short and tall individuals)
- Exaggerated in the presence of oedema

The subject should be weighed in light robe or undergarments, with the shoes off, preferably using a beam-balance scale. The height should also be measured with the shoes off.

### 5.2.2. Waist Circumference (WC)

The BMI does not provide any indication of the distribution of fat in the body. Truncal distribution of adipose tissue (around and in the abdomen) has a particularly strong relationship with the adverse metabolic and vascular effects of obesity while fat deposited around the hips carries a much lower burden of disease.

### 5.2.3. Waist-Hip Ratio (WHR)

Waist Hip Ratio (WHR) is another simple measurement that has been used in epidemiological studies in the past but does not provide additional information compared to WC. The values that are associated with an increase abdominal fat and increased risk of hypertension, diabetes and ischaemic heart disease are (5)

- WHR > 0.9 for men
- WHR > 0.85 for women

However, waist circumference is the preferred measure of abdominal obesity compared to the WHR (5).

NB:

When using circumference measurements it is important that standard anatomical locations are used. The WHO (23) recommended methods are as follows:-

1. Subject stands with feet 25 - 30 cm apart, weight evenly distributed.
2. Waist measurement is taken midway between the inferior margin of the last rib and the crest of the ilium in a horizontal plane. The measurer sits by the side of the subject and fits the tape snugly but not compressing soft tissues.
3. Circumference is measured to nearest 0.1 cm.
4. For hip circumference the measure is taken around the pelvis at the point of maximal protrusion of the buttocks.

**Table 5.1 : Co-morbidities risk associated with different levels of BMI and suggested waist circumference in adult**

Classification	BMI (kg/m <sup>2</sup> )	Risk of co-morbidities	
		Waist circumference	
		<85 cm (men)	<sup>3</sup> 85 cm (men)
		<80 cm (women)	<sup>3</sup> 80 cm (women)
<b>Underweight</b>	<18.5	Low (but increased risk of other clinical problems)	Average
<b>Normal range</b>	18.5 – 22.9	Average	Increased
<b>Overweight : BMI <sup>3</sup> 23.0</b>			
<b>Pre-Obese</b>	23.0 – 27.4	Increased	Moderate
<b>Obese I</b>	27.5 – 34.9	Moderate	Severe
<b>Obese II</b>	35.0 – 39.9	Severe	Very severe
<b>Obese III</b>	≥ 40	Very severe	Very severe

### **5.3. Assessment and Identification of patients at high risk**

Obesity-associated diseases and risk factors contribute to an added risk of cardiovascular morbidity and mortality and will require aggressive intervention. Identifying these risk factors will provide an additional guide to the need and intensity of any weight-reducing intervention.

#### **5.3.1. Coronary Heart Disease (CHD) equivalents**

- a) Established Ischaemic Heart Disease
- b) Other atherosclerotic diseases e.g. Cerebrovascular accidents, Peripheral Vascular Diseases
- c) Type 2 diabetes mellitus

#### **5.3.2. Cardiovascular Risk Factors**

- a) High LDL-C ( $> 4.13$  mmol/L)
- b) Low HDL-C ( $< 0.9$  mmol/L)
- c) High TG ( $> 2.26$  mmol/L)
- d) Hypertension
- e) Impaired Fasting Glycaemia and Impaired Glucose Tolerance
- f) Cigarette smoking
- g) Family history of premature IHD (First degree relative with onset before age 55 for males, and 65 for females)
- h) Age (Male  $\geq 45$ , Female  $\geq 55$  or postmenopausal)

### **5.4. Assessment and identification of other related diseases**

Obese patients are at increased risk for several medical conditions that require detection and appropriate management as listed :-

- i. Gynaecological abnormalities
- ii. Osteoarthritis
- iii. Gallstones
- iv. Stress incontinence

### **5.5. Assessment and identification of underlying aetiology of Obesity**

Obesity results from interaction between underlying genetic predisposition and environmental factors. These factors should be identified and managed appropriately.

#### **5.5.1. Social and Behavioural Factors**

1. Positive behaviour is essential to ensure effective weight management. Long-term management will be more successful with sufficient continued support. Thus, assessment of behavioural (Refer Appendix 5.1) and social factors are important.
2. Weight gain is very common when people stop smoking. This is thought to be mediated at least in part by nicotine withdrawal.

### **5.5.2. Sedentary Lifestyle**

1. Enforced inactivity (postoperative)
2. Elderly

### **5.5.3. Iatrogenic Causes**

1. Drugs and hormones
2. Hypothalamic surgery

### **5.5.4. Endocrine Obesities**

1. Hypothalamic syndrome
2. Hypothyroidism
3. Polycystic Ovarian syndrome
4. Cushing's Syndrome
5. Acromegaly
6. Hypothalamic disorders
7. Growth hormone deficiency
8. Pseudohypoparathyroidism
9. Hypogonadism e.g – Klinefelter's syndrome and Kallman's syndrome

### **5.5.5. Genetic Obesities**

Autosomal recessive traits

Autosomal dominant traits

X-linked traits

Chromosomal abnormalities

## **6. THERAPY**

### **6.1. GOALS FOR OBESITY THERAPY**

The general goals are :-

- Achieve weight loss
- Maintain lower body weight
- Prevent further weight gain
- Treat comorbidities / underlying causes

#### **6.1.1. Achieve Weight Loss**

- **Target levels for weight loss (Evidence Level B) (24)**

Aim for 10% reduction from baseline weight as this can significantly decrease the severity of obesity associated risk factors. This is a realistic and achievable target that can be maintained over time. Further weight loss can be considered after this initial goal is achieved and maintained for 6 months.

- **Rate of weight loss (Evidence Level B) (25)**

A reasonable goal is a 10% weight reduction from baseline over 6 months of therapy. A calorie deficit of 500 to 1000 kcal/day can result in weight loss at a rate of 0.5 to 1

kg/week. Rapid weight reduction may lead to increased risk of gallstones, electrolyte abnormalities and weight regain.

### 6.1.2. Maintain Lower Body Weight (Evidence Level B) (25)

The rate of weight loss often declines after the initial 6 months of weight reduction after which weight maintenance should then be the priority (defined as a weight regain of < 3kg in 2 years and a sustained reduction in waist circumference of at least 4cm). The combined modalities of therapy (diet, physical activity and behaviour therapy) must be continued indefinitely to ensure weight maintenance. Drug therapy is helpful in the weight maintenance phase.

### 6.1.3. Prevent Further Weight Gain

If significant weight reduction is not achievable, prevention of further weight gain becomes an important goal as it does not exacerbate the disease risk. Prevention of further weight gain can be considered as partial therapeutic success for many patients.

## 6.2. OVERALL APPROACH FOR THE TREATMENT OF OVERWEIGHT AND OBESITY IN ADULTS

Table 6.1: Recommended treatment options for different levels of BMI and other risk factors.

	<b>Lifestyle changes</b> (Diet, Physical activity, Behaviour therapy)	<b>Anti-Obesity Drug</b>	<b>VLCD</b> (with supervision)	<b>Surgery</b>
<b>BMI 18.5 –22.9 kg/m<sup>2</sup></b> with Increased WC*	▼			
<b>BMI 23.0 –24.9 kg/m<sup>2</sup></b>	▼			
<b>BMI 25.0 – 27.4</b> No additional risk Increased WC* / DM/CHD/HT/HL	▼ ▼	▼ (consider in the presence of <sup>3</sup> 2 risk factors)		
<b>BMI 27.5 - 34.9 kg/m<sup>2</sup></b>	▼	▼	▼ (consider in the presence of <sup>3</sup> 2 risk factors) (Refer Section 6.3.3)	
<b>BMI 35.0 – 39.9 kg/m<sup>2</sup></b> No additional risk Increased WC* / DM/CHD/HT/HL	▼ ▼	▼ ▼	▼ (Refer Section 6.3.3) ▼ (Refer Section 6.3.3)	▼ (consider in the presence of <sup>3</sup> 2risk factors)
<b>BMI<sup>3</sup> 40.0 kg/m<sup>2</sup></b>	▼	▼	▼ (Refer Section 6.3.3)	▼

### Key:

DM: Type 2 diabetes mellitus  
HT: Hypertension

CHD: coronary heart disease  
HL: Hyperlipidaemia

\* Waist circumference > 85 cm (men), > 80 cm (women)

### 6.3. DIETARY THERAPY

The goal of the treatment of obesity is to achieve weight loss through a decrease in calories consumed and an increase in energy expended.

#### 6.3.1. Low Calorie Diet

Low Calorie Diet (LCD) provides a calorie deficit of 500 to 1000 kcal/d from maintenance requirement and is important for weight loss and prevention of weight regain.

LCDs reduce total body weight (average of 8-10% over 6 months) and waist circumference. Weight loss usually consists of about 75% fat (mainly abdominal fat) and 25% lean tissue (26). Mean weight loss of up to 11kg, and a concomitant reduction in waist circumference of 1.5 to 9.5cm may be achieved after 6 to 12 months (27, 28).

#### **Evidence Level A**

A moderate reduction in caloric intake, which is individually designed to achieve a slow, but progressive weight loss is recommended. The rate of weight loss is directly related to the difference between the patient's energy intake and energy requirements.

There is wide variability because sex, age and genetic factors influence energy requirements:

- Men lose more weight than females of similar height because they have more lean body mass and therefore higher energy expenditure.
- Older patients of either sex have lower reduction in lean body mass and physical activity; metabolic rate declines by approximately 2 percent per decade. Therefore they lose weight slower than younger subjects.

To estimate energy requirement for weight reduction and weight maintenance, a simplified formula as in Table 6.2 may be used.

**Table 6.2 : Quick Formula for calculating calorie requirements for weight reduction\* and weight maintenance\*\***

Activity Status#	Overweight & Obese* (BMI > 23)	Normal Weight** (BMI 18.5 – 22.9)
Sedentary	20 -25 kcal/kg	30 kcal/kg
Moderate activity	25 - 30 kcal/kg	35 kcal/kg
Marked activity	30 – 35 kcal/kg	40 kcal/kg

Adapted from (29)

Weight for calculation: Use current body weight for all except in the obese (BMI > 27.5) and underweight (BMI < 18.5), calculate using acceptable weight instead i.e. BMI 22)

#### # Activity Status

- **Sedentary**

This refers to persons who spend most of their work sitting with regular upper body movements and those who spend much of their time on their feet but who carry only light loads. Not usually enough to cause shortness of breath.

Example: Office workers, teacher, nurse, students, housewives without mechanical appliances, musicians, hawker, sales/shop assistant, taxi/bus driver, tailor, waiter, factory worker, machine operator, electrician, etc.

- **Moderate activity**

This refers to persons whose jobs involve some lifting and carrying, shoveling etc, which will, at least several times a day, result in some shortness of breath and perspiration.

Example: Carpenter, mechanics, plumber and some electrical workers; gardener/farmer, cleaners, fishermen.

- **Marked activity**

This applies to those in jobs consistently require them to carry/lift heavy loads or move vigorously such they are regularly short of breath and perspiring or with regular daily physical exercise programs.

Example: Labourer, construction worker, house painter, heavy industry machine operator, professional sports person, army cadet, etc.

In general, LCDs containing 1,000 to 1,200 kcal/day should be selected for most women; a diet between 1,200 kcal/day and 1,500 kcal/day should be chosen for men and may be appropriate for women who weigh 75 kg or more, or who exercise regularly. If the patient is unable to lose weight on 1,500 kcal/day diet, a 1,200 kcal/day diet may be tried. If a patient on either diet is hungry, the calorie intake can be increased by 100 to 200 kcal/day. (*Please refer Appendix 6.1 for sample diets.*)

Care should be taken to ensure that all of the recommended dietary allowances are met.

The composition of the diet should be modified to minimise other cardiovascular risk factors such as hypercholesterolaemia and hypertension (30).

### **6.3.2. Lower-Fat Diet**

Lower-fat diets provide 25 to 30% of calories from fat. They produce weight loss primarily by decreasing caloric intake. However, lower-fat diets with total caloric reduction produce greater weight loss compared with lower-fat diet alone (31). **Evidence Level A**

### **6.3.3. Very Low-Calorie Diet (VLCD)**

VLCD (200 and 800 kcal/day) is often in a form of liquid nutritional supplement and results in the most rapid weight loss (32). It is appropriate only when the patient faces a major health risk and the physician has determined that such a diet can be used safely. It is reserved for patients who have BMIs > 30 and have failed other approaches (33)

**Evidence Level B.** This should be done under close medical supervision.

VLCDs are not usually recommended for weight loss therapy because: -

- It results in nutritional inadequacies unless it is supplemented with vitamins and minerals.
- It is not sustainable over long period

- It increases serum uric acid concentrations
- It results in muscle breakdown and protein loss

#### Contraindications to VLCD

- Recent myocardial infarction
- Cardiac conduction disorder
- History of cerebrovascular, renal or hepatic disease
- Type 1 diabetes mellitus
- Major psychiatric disorders
- Gallbladder disease

#### **6.3.4. High-Protein Low-Carbohydrate Diet**

High Protein diets with low carbohydrates restrict food choices and overall nutrient adequacy. There is insufficient evidence to make recommendations for or against the use of low-carbohydrate diets, particularly among those aged more than 50 years, for use longer than 90 days or for diets of  $\leq 20$  g carbohydrates per day. Participants' weight loss while using low-carbohydrate diets was principally associated with decreased caloric intake and increased diet duration but not with reduced carbohydrate content (34).

**Evidence Level A**

#### **6.3.5. Dietary Education**

All weight management strategies should include education in healthy eating habits. Patients should avoid 'fad' diets. Dietary education is necessary to assist in the adjustment to an LCD. Educational efforts should pay particular attention to the following topics (25):

- Energy value of different foods
- Food composition -fats, carbohydrates (including dietary fiber), and proteins
- Evaluation of nutrition labels to determine caloric content and food composition
- Development of preferences for low-calorie foods
- Reduction of high-calorie foods (both high-fat and high-carbohydrate foods)
- Food preparation – limiting fats and oils during cooking
- Maintenance of adequate water intake
- Reduction of portion sizes; and
- Limiting alcohol consumption

Long-term changes in food choices are more likely to be successful when the patient's preferences are taken into account and should include behaviour therapy (Refer to Section 5.5 )

Periodic review on the progress of the weight loss therapy should be carried out. Optimally, dietary therapy should last at least 6 months. Shorter periods of dietary therapy usually result in lesser weight reductions

### **6.4. PHYSICAL ACTIVITY**

Physical activity should be an integral part of weight loss therapy and weight maintenance (**Evidence Level A**) (25). It contributes to weight loss by altering energy balance. It favourably changes body composition, decreases risk for disease, and improves quality of life.

Before the patient starts an exercise programme, the attending doctor must give medical clearance based on patient's age, symptoms, concomitant risk factors and physical examination.

In choosing an appropriate exercise programme, the **FITT** criteria should be considered:

**F = Frequency**

**I = Intensity**

**T = Time (duration)**

**T = Type of exercise**

All exercise programmes should be introduced gradually. Patients should be advised on the possible abnormal responses to exercise (chest pain, excessive breathlessness).

Thirty minutes of regular moderate intensity physical activity, preferably all days of the week, can limit health risks for chronic diseases including coronary heart disease and diabetes. However, to prevent weight regain for formerly obese individuals requires 60 – 90 minutes per day of moderate intensity activity or lesser amounts of vigorous intensity activity. (35) (*Evidence Level C*).

A regimen of daily walking is an attractive form of physical activity for those who are overweight or obese. Initially the patient can start by walking 10 minutes, 3 days a week, and can build to 30 to 45 minutes more intense walking at least 3 days a week and increase to most, if not all, days (25). The exercise can be done all at one time or accumulated over the day. Extremely obese persons may need to start with simple exercises that can be intensified gradually as shown below.

**Light:**

Slow walking (15 min/km, or 4 km/hr), tai chi, house cleaning, and golf (no buggy)

**Moderate :**

Brisk walking (10 min/km, or 6 km/hr), active gardening, cycling (2.5min/km, or 24 km/hr), badminton, swimming and aerobic exercise/dancing.

**High :**

Jogging (6 min/km, or 10 km/hr), walking with load uphill, basketball, climbing and football.

**In addition to intensity, the following should also be encouraged (5):**

- flexibility exercises to attain full range of joint motion,
- strength or resistance exercises and
- aerobic conditioning.

Each level of intensity and duration should be maintained for at least 1 to 2 weeks

Care must be taken to avoid injury. Progressing too rapidly will result in muscle soreness, fatigue, increased cardiac risk, and decreased motivation. Each exercise period should include warm-up and cool-down periods. Drink plenty of water before, during and after exercise to prevent dehydration

In addition, patients should be encouraged to adopt strategies to increase physical activity in daily life, e.g. taking the stairs instead of the lift and reducing sedentary time (e.g. watching television) by undertaking frequent, less strenuous activities

## **6.5. BEHAVIOUR THERAPY**

Behaviour therapy is a useful adjunct when incorporated into the treatment for weight loss and weight maintenance. The goal of behavior therapy is to alter the eating habits of an obese patient. Weight loss is more likely to be achieved and maintained by behaviour

modification techniques that focus on lifestyle and attitude. Behaviour therapy strategies include (36);

**Counseling** for lifestyle changes is important as it enables patients to evaluate and modify eating practices, habits of physical activity and emotional responses to weight.

**Self-monitoring** is an essential component of a lifestyle change program and patients should be encouraged to keep daily records of physical activity, food intake and problems.

**Portion control** to gauge size portions eaten.

**Stimulus control** to identify and avoid environmental cues associated with unhealthful eating and sedentary lifestyle eg. Snacking while watching television.

**Contingency management** includes the use of rewards for positive lifestyle changes.

**Stress management**, which include meditation, relaxation techniques and regular physical activity to cope with stress.

**Cognitive-behavioral strategies** to change a patient's attitudes and beliefs about unrealistic expectations and body image.

**Weight loss support groups** to reduce uncertainty about self-worth. Helps to sustain weight loss behaviour.

No single method of behaviour therapy appears superior to any other in its effect on weight loss; rather, multiple strategies appears to work best and those interventions with the greatest intensity appears to be associated with the greatest weight loss. Long-term follow-up of patients on behaviour therapy show weight regain to baseline in most patients in the absence of continued behavioural intervention.

## 6.6. PHARMACOTHERAPY

Pharmacotherapy may be considered in addition to diet, exercise and behaviour modification. The decision to initiate drug therapy in overweight subjects should be made only after a careful evaluation of risks and benefits. It should be part of a long-term management strategy for obesity.

A patient may require drug therapy :-

- to aid compliance with dietary restriction
- to augment diet-related weight loss
- to achieve weight maintenance after satisfactory weight loss.

The risks to a patient from continuing obesity need to be balanced against the risks from therapy, and doctors need to be aware of possible side-effects.

### 6.6.1. Indications for Pharmacotherapy

Pharmacotherapy must not be used simply for cosmetic purposes or when weight loss can be achieved and maintained without it. Overweight subjects should only receive anti-obesity drugs if they have had a reasonable trial of diet and exercise and have:

1. BMI between 25 and 27.5 kg/m<sup>2</sup>, and at least two of the following conditions:
  - Type 2 diabetes mellitus
  - Coronary heart disease
  - Cerebrovascular disease
  - Hypertension

- Hyperlipidaemia
  - Waist circumference >85 cm for men, >80 cm for women
2. BMI  $\geq 27.5$  kg/m<sup>2</sup>.
  3. Symptomatic complications of obesity such as severe osteoarthritis, obstructive sleep apnoea, reflux oesophagitis, and the compartment syndrome.

### **6.6.2. Goals of Therapy**

The goal of therapy must be realistic. Therapy is considered effective if weight loss exceeds 2 kg during the first month of therapy and decreases more than 5% by 3 to 6 months, with no weight regain.

### **6.6.3. Types of anti-obesity drugs**

Anti-obesity drugs can be classified into two groups, those acting on the:

- Gastrointestinal system to reduce fat absorption
- Central nervous system to suppress appetite.

#### **6.6.3.1. Drugs acting on the gastrointestinal system**

##### **1. Orlistat**

Orlistat is the only non-systemically acting drug available for the long-term treatment of obesity. It is a pancreatic lipase inhibitor which produces a dose-dependent reduction in dietary fat absorption by about 30%. In the 2-year European Study, patients treated with orlistat showed a reduction of 10.2% in weight compared to 6.1% in the placebo group at the end of one year. Weight loss at one year varied from 5.5 to 6.6% of initial body weight in the placebo group and 8.5 to 10.2% in the orlistat group. In diabetic patients, orlistat resulted in 6% reduction in weight compared with 4.3% in placebo after one year (37).

- **Other beneficial effects :-**
  - Improves certain serum lipid values more than can be explained by weight reduction alone (38-40). (Probably related to fecal fat loss)
  - Improvements in glycemic control and blood pressure have also been noted with orlistat (37). These changes may result from decreases in body weight alone.
- **Side effects :** Orlistat is generally well-tolerated. Known side effects are intestinal borborygmi and cramps, flatus, fecal incontinence, oily spotting, and flatus with discharge (37). These are usually mild and subside after the first several weeks of treatment provided fat intake is reduced.  
Absorption of vitamins A and E is reduced in some patients receiving orlistat. It is advisable to take multi-vitamin supplement at least 2 hours before or after the dose of orlistat.

### **6.6.3.2. Drugs acting on the central nervous system**

#### **2. Sibutramine**

*Sibutramine* specifically inhibits serotonin and noradrenaline re-uptake without affecting their release. It enhances post-ingestive satiety and increases resting metabolic rate. Sibutramine typically induces weight loss of 5-8% compared with 1-4% in placebo treated groups. In a randomised, double-blind trial to assess the usefulness of sibutramine in maintaining substantial weight loss over 2 years, 43% of treated subjects maintained their reduced weight, compared with 16% in the placebo group (41).

##### **Other benefits:**

Sibutramine induced weight loss is associated with improvements in

- Hyperlipidemia and hyperuricemia (42)
- Glycaemic control in type 2 diabetic patients (43)

##### **Side Effects:**

Sibutramine increases blood pressure (1-3 mmHg) and pulse rate (4 - 5 bpm). Thus, it should be given cautiously in subjects with uncontrolled hypertension. Other adverse reactions include dry mouth, headache, insomnia and constipation.

##### **Contraindications:**

- Subjects receiving a monoamine oxidase inhibitor or selective serotonin reuptake inhibitor
- Concomitant use with drugs metabolized by the cytochrome P450 enzyme system (isozyme CYP3A4) e.g. - erythromycin and ketoconazole

#### **2. Phentermine**

*Phentermine* is an amphetamine derivative that suppresses appetite. It induces moderate weight loss of 2 to 10 kg. Phentermine is recommended only for short-term use ( $\leq 3$  months) because of their stimulant action on the central nervous system.

##### **Side effects:**

Include insomnia, dry mouth, constipation, euphoria, palpitations and hypertension.

### **6.6.4. Other Drugs that induce weight loss**

The following drugs are not approved for the treatment of obesity but may induce weight loss when used for their specific indications.

*Metformin* may be useful in managing obesity in those with type 2 diabetes, PCOS, and impaired glucose tolerance. Care should be taken with its use in subjects with cardiac, renal or hepatic decompensation as it may result in lactic acidosis. Side effects include nausea, flatulence, bloating and diarrhoea. *Fluoxetine*, a serotonergic anti-depressant, has modest effects on appetite and weight. It can be used as a surrogate anorectic agent in depressed obese patients. Side effects include anxiety, drowsiness, insomnia and nervousness.

### **6.6.5. Agents not appropriate for the treatment of obesity**

There is no evidence that any alternative therapies/proprietary medicines such as cellulite treatments, dietary supplements (e.g. chitosan, fibre capsules), or herbal preparations are effective. Adequate clinical trials have not been performed.

*Guar gum preparations* derived from the Indian cluster bean has been promoted as weight reduction agents. In a meta-analysis of 20 clinical trials guar gum was not effective for weight loss (44).

*Diuretics, laxatives (including 'slimming tea'), human growth hormone (HGH)* are ineffective and should not be used. Treatment with amphetamine, dexamphetamine and thyroxine may be dangerous and these agents must not be used to achieve weight loss.

### **6.6.6. Antiobesity agents under development**

#### **6.6.6.1. Leptin**

Leptin is a peptide produced primarily in adipose tissue (45). Leptin deficiency is a rare cause of obesity. In these patients, physiological doses of leptin decreases food intake and causes weight loss (46). Most obese subjects appear to have leptin resistance. In a study of 47 obese subjects given placebo or varying doses of recombinant human leptin for 24 weeks, there was a weakly dose-dependent decrease in body weight (47). The decrease in weight was due mostly to loss of fat. A long-acting leptin preparation had similar effects (48).

#### **6.6.6.2. Neuropeptide-Y**

Neuropeptide-Y is one of the most potent stimulators of food intake. It appears to act via Y-5 receptors, although Y-1 receptors may also transmit feeding effects. Antagonists to these receptors may block the action of neuropeptide-Y, and thereby decrease food intake.

#### **6.6.6.3. Glucagon and glucagon-like peptide-1**

Pancreatic glucagon causes a dose-related decrease in food intake. A fragment of glucagon (amino acids 6-29) called glucagon-like peptide-1 when given parenterally reduced food intake (49).

#### **6.6.6.4. Beta-3 adrenergic receptor agonists**

Blockade of the thermogenic part of sympathetic nervous system reduces the thermic response to a meal. Noradrenaline may decrease food intake by acting on beta-2 or beta-3 adrenergic receptors. Several synthetic beta-3 adrenergic agonists have been developed, but clinical responses have been disappointing.

### **6.6.7. Contra-indications to the use of anti-obesity drugs**

Anti-obesity drugs are not recommended for certain sub-groups:-.

- Children
- Patients who have previously suffered adverse effects from drugs in this category
- Pregnant and lactating women

**Combination pharmacotherapy for the treatment of obesity cannot yet be recommended outside clinical trials.**

<b>Drug</b>	<b>Action</b>	<b>Adverse effects</b>	<b>Dosage</b>
Orlistat	Peripherally acting pancreatic lipase inhibitor, decreases fat absorption	Loose stools, malabsorption of fat-soluble vitamins	120 mg 3 times/day with each main meal containing fat (during or up to 1 hour after the meal); omit dose if meal is missed or contains no fat
Sibutramine*	Centrally acting via serotonergic and nonadrenergic pathways, not recommended for those with severe hepatic disease	Increase in blood pressure and heart rate, nausea, insomnia dry mouth, rhinitis, constipation	Initial: 10 mg once daily; after 4 weeks may titrate up to 15 mg once daily as needed and tolerated
Phentermine	Centrally acting via nonadrenergic pathways	Increase in blood pressure, insomnia nervousness	8 mg 3 times/day 30 minutes before meals or food or 15-37.5 mg/day before breakfast or 10-14 hours before retiring
<b>Other Drugs that Induce Weight Loss</b>			
<b>Drug</b>	<b>Action</b>	<b>Adverse effects</b>	<b>Dosage</b>
Fluoxetine (Prozac)	Anti-depressant, appetite suppressant and a selective serotonin re-uptake inhibitor. Not specifically approved for weight loss	Anxiety, drowsiness insomnia, nervousness	20 mg/day in the morning; may increase after several weeks by 20 mg/day increments; maximum: 60 mg/day
Metformin	This may be useful in managing obesity in the Type 2 diabetic patient, although efficacy is not proved or licensed for obesity	Nausea, flatulence, bloating, diarrhoea, lactic acidosis (rare)	500 – 1000mg 2-3 times/day with meals

\* Not available in Malaysia at the time of publication of this guidelines

## 7. Surgery for Weight Loss

Surgery is an option for weight reduction for some patients with severe and resistant morbid obesity. It should be reserved for patients with severe obesity, in whom efforts at other therapy have failed, and who are suffering from serious complications of obesity. Surgical approaches can result in substantial weight loss i.e. - from 50 kg to as much as 100 kg over a period of 6 months to 1 year. Compared to other interventions available, surgery has produced the longest period of sustained weight loss. In a recent retrospective study, obese patients with Type 2 diabetes who underwent surgery had a decrease in mortality rate for each year of follow up (50).

Assessing both peri-operative risk and long-term complications is important and requires assessing the risk/benefit ratio in each case. A multidisciplinary team should follow patients opting for surgical intervention.

### 7.1. Criteria for Surgical Therapy (51)

- Patients aged 18 or older with morbid obesity (BMI =40 kg/m<sup>2</sup> or between 35 and 40, with major weight related comorbidities)
- Patients who have already had intensive management in specialized obesity clinics.
- Patients who have failed to maintain weight loss after trying appropriate non-surgical measures.
- Patients with no clinical or psychological contraindications to anaesthesia or surgery
- Patients who understand and are committed to long term followup.

### 7.2. Surgical Techniques in Current Use

The aim of surgery is to modify the gastrointestinal tract to reduce net food intake. Commonly used surgical interventions in Malaysia include gastric partitioning (Vertical gastric banding) and gastric bypass (Roux-en-Y) . Another procedure is the biliopancreatic bypass procedure, which involves transection of the stomach and anastomosis of the proximal part with a segment of ileum. This operation results in malabsorption, but avoids the complications of a blind loop associated with earlier intestinal bypass procedures (52). (See Appendix 7.1)  
Liposuction is not a treatment for generalised obesity, but may be used for unsightly local collections of fat.

### 7.3. Complications of Surgical Therapy

- Potential nutrient deficiencies e.g. vitamin B<sub>12</sub>, folate, and iron.
- Gastrointestinal symptoms such as “dumping syndrome” or gallstones.
- Postoperative mood changes or presurgical depression symptoms may not be improved by the achieved weight loss.

Complications related to specific surgical techniques are shown in Table 7.1  
*Lifelong medical and nutrition surveillance after surgical therapy* should include monitoring of indices of inadequate nutrition and modification of any preoperative disorders.

**Table 7.1 : Complications of Gastric Reduction Surgery**

Complications of Gastric Reduction Surgery		
Complications	Gastric bypass, percent	Gastroplasty, percent
Death	<1	<1
Technical / metabolic	7	7
Anemia	3	
Stenosis		4
Weight loss (percent initial weight)	30 to 25	20 to 25
Surgical Failure (20 percent weight loss)	5	20

Surgical revision needed	5	10
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## 8. PEDIATRIC AND ADOLESCENT OBESITY

Several reports show already high and increasing rates of overweight and obesity preschool children living in developing countries (5, 53, 54). Children become overweight for a variety of reasons. The most common causes are unhealthy eating patterns, lack of physical activity, genetic factors, or a combination of these factors. In rare cases, a medical problem, such as an endocrine disorder, may cause a child to become overweight.

### 8.1. Evaluation of Obesity

BMI is the best simple way to measure obesity, though imperfect. BMI cut-off points based on national centiles are useful clinically. Recently, the International Obesity Task Force (IOTF) has adopted cut-off points of BMI for overweight and obesity in children to standardize the assessment of obesity worldwide, based on 6 large national BMI surveys (55).

**Table 8.1 : The IOTF cut-off points of BMI for overweight and obesity by sex from 2 – 18 years**

Age (yrs)	Body Mass Index 25 kg/m <sup>2</sup>		Body Mass Index 30 kg/m <sup>2</sup>	
	Males	Females	Males	Females
2	18.41	18.02	20.09	19.81
2.5	18.13	17.76	19.80	19.55
3	17.89	17.56	19.57	19.36
3.5	17.69	17.40	19.39	19.23
4	17.55	17.28	19.29	19.15
4.5	17.47	17.19	19.26	19.12
5	17.42	17.15	19.30	19.17
5.5	17.45	17.20	19.47	19.34
6	17.55	17.34	19.78	19.65
6.5	17.71	17.53	20.23	20.08
7	17.92	17.75	20.63	20.51
7.5	18.16	18.03	21.09	21.01
8	18.44	18.35	21.60	21.57
8.5	18.76	18.69	22.17	22.18
9	19.10	19.07	22.77	22.81
9.5	19.46	19.45	23.39	23.46
10	19.84	19.86	24.00	24.11
10.5	20.20	20.29	24.57	24.77
11	20.55	20.74	25.10	25.42
11.5	20.89	21.20	25.58	26.05
12	21.22	21.68	26.02	26.67
12.5	21.56	22.14	26.43	27.24
13	21.91	22.58	26.84	27.76
13.5	22.27	22.98	27.25	28.20
14	22.62	23.34	27.63	28.57
14.5	22.96	23.66	27.98	28.87
15	23.29	23.94	28.30	29.11
15.5	23.60	24.17	28.60	29.29
16	23.90	24.37	28.88	29.43

16.5	24.19	24.54	29.14	29.56
17	24.46	24.70	29.41	29.69
17.5	24.73	24.85	29.70	29.84
18	25	25	30	30

Evaluation of obesity in children and adolescents is important for several reasons:-

- Prevent the progression of the condition and its related co morbidities into adulthood.
- Genetic and hormonal causes of obesity warrant consideration, although rare.
- Prevention of psycho-social problems e.g. low self-esteem.
- To instill healthy lifestyle in children and their families throughout their life.

Obese children must be evaluated for associated morbidity as they develop similar complications as for adult (see section 3). In particular, childhood obesity is associated with the increase in prevalence of Type 2 diabetes at a younger age.

Factors determining persistence of obesity into adulthood (56) :-

- Onset of obesity after the age of three. The likelihood of obesity persisting increases with advancing age and 70-80% of obese adolescents will remain so as adults.
- Degree of obesity.
- Presence of obesity in at least one parent.

## 8.2. Management of Childhood Obesity:

The overriding aim is to reduce the amount of body fat. Children who are growing, and thus gaining both height and weight, often do not need to lose weight. They can maintain their weight and be allowed to “grow into” it. Older adolescents who have attained their final height should make efforts to lose excess weight.

The components of obesity management in children and adolescents are: (57) (see Table 8.2)

- Reduction of energy intake by dietary modification, and using conventional foods.
- Increase energy expenditure by increasing physical activities and decreasing physical inactivity.
- Behaviour modification associated with eating habits and activity pattern.
- Involvement of the family in the process of change.

**TABLE 8.2 : Components of a Successful Weight Loss Plan**

<ul style="list-style-type: none"> <li>▪ Reasonable weight-loss goal <ul style="list-style-type: none"> <li>○ Prolonged weight maintenance is recommended.</li> <li>○ If weight loss is indicated, initially to lose 2-4 kg, or a rate of 1/2 to 2kg per month.</li> </ul> </li> <li>▪ Dietary management <ul style="list-style-type: none"> <li>○ Provide dietary prescription specifying total number of calories per day and recommended percentage of calories from fat, protein and carbohydrates.</li> </ul> </li> </ul>
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- Physical activity
  - Start according to child's fitness level, with ultimate goal of more than 60 minutes per day of moderate exercise including family-oriented outdoor activities, organised sports, swimming, cycling, martial arts.
  - Limiting television viewing and playing video and computer games appears to compel the choice of other pastimes.
  
- Behavior modification
  - Self-monitoring, nutritional education, stimulus control, modification of eating habits, physical activity, attitude change, reinforcements and rewards.
  
- Family involvement
  - The best and most effective way to treat children with obesity is to treat the family and not the child alone, by encouraging increased daily activity and healthy eating habits.
  - Review family activity and television viewing patterns; involve parents in nutrition counseling.

The currently available VLCD, pharmacotherapeutic agents and surgery generally have no place in the management of childhood obesity (57). When a child does develop obesity, a serious attempt to treat it should be undertaken.

### **8.3. Prevention of Obesity**

The best way to significantly affect the prevalence of obesity is to prevent it. (see Table 6.3)

**TABLE 8.3 : Tips for Parents for Prevention of Obesity**

<ul style="list-style-type: none"> <li>• Respect your child's appetite: children do not need to finish every bottle or meal.</li> <li>• Avoid pre-prepared and sugared foods when possible.</li> <li>• Limit the amount of high-calorie foods kept in the home.</li> <li>• Provide a healthy diet, with 30 percent or fewer calories derived from fat.</li> <li>• Provide ample fiber in the child's diet.</li> <li>• Skimmed milk may safely replace whole milk at 2 years of age.</li> <li>• Do not provide food for comfort or as a reward.</li> <li>• Do not offer sweets in exchange for a finished meal.</li> <li>• Limit amount of television viewing and computer games.</li> <li>• Encourage active play.</li> <li>• Establish regular family activities such as walks, ball games and other outdoor activities.</li> </ul>
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## 9. Appendices

### *Appendix 5.1: A Brief Behavioural Assessment*

Clinical experience suggests that health care practitioners briefly consider the following issues when assessing an obese individual's readiness for weight loss

**1. "Has the individual sought weight loss on his or her own initiative?"**

The initiation to lose weight should arise from the patients' self-awareness of obesity as a health problem

**2. "What events have led the patient to seek weight loss now?"**

This provides information about the patients' motivation and goals for weight loss. Certain events may have prompted the patients to seek medical advice for weight loss.

**3. "What are the patient's stress level and mood?"**

Individuals with high stress levels may not be able to focus on weight control. Treatment should commence after the stress has been resolved. Major depression has to be excluded before undertaking weight reduction measures.

**4. "Does the individual have an eating disorder, in addition to obesity?"**

- Binge eating involves irregular meal plan and uncontrolled eating of unusually large amount of food, and experiencing loss of control while overeating. Ask patients which meals they typically eat and the times of consumption. These patients may need psychological and nutritional counselling.

**5. "Does the individual understand the requirements of treatment and believe that he or she can fulfill them?"**

Practitioner and patient together should select an individually tailored course of treatment and identify the changes in eating and activity habits that the patient wishes to make. It is important to select activities that patient believe they can perform successfully.

**6. "How much weight does the patient expect to lose? What other benefits does he or she anticipate?"**

Practitioners must help patients understand that modest weight loss frequently improved health complications of obesity.

*Adapted from (25)*

**Appendix 6.1 : Sample Menu Plan (55% CHO, 15% Protein and 30% Fat)**

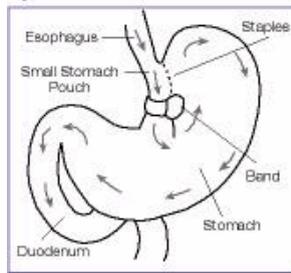
Food Exchanges	1200 kcal		1500 kcal	
	No of Exchanges	Food Portion	No of Exchanges	Food Portion
<b>BREAKFAST</b>				
Cereal/Grains	2	2 pcs bread	3	1 ½ cup noodles
Fat	1	1 tsp margarine	1	1 tsp oil
Skim Milk	1	1 cup	1	1 cup
<b>LUNCH</b>				
Cereal/Grains/Starchy Vegetables	3	1 ½ cup rice	4	2 cup rice
Fish	1 ½	1 ½ matchbox size	2	2 matchbox size
Fat	3	3 tsp oil	4	4 tsp oil
Fruit	1	1 banana	1	1 slice papaya
Vegetables	1 ½	¾ cup (cooked)	1 ½	¾ cup (cooked)
<b>SNACK</b>				
Cereal/Grains	1	3 pcs biscuits	1	3 pcs biscuits
<b>DINNER</b>				
Cereal/Grains/Starchy Vegetables	2	1 cup rice	3	1 cup rice
Lean Meat	1 ½	1 ½ matchbox size	2	2 matchbox size
Fat	2	2 tsp oil	3	3 tsp oil
Fruit	1	1 orange	1	1 slice pineapple
Vegetables	1 ½	¾ cup (cooked)	1 ½	¾ cup (cooked)
<b>SUMMARY</b>				
Cereal/Grains/Starchy Vegetables	8		11	
Fish	1 ½		2	
Lean Meat	1 ½		2	
Skim Milk	1		1	
Fat	6		7	
Fruit	2		2	
Vegetables	3		3	

**Samples of Food exchanges:**

½ cup rice can be exchanged for 1 slice of bread or ½ c noodles or 3 pieces of crackers  
 1 fruit refers to 1 hawker-size slice of papaya/ watermelon/ pineapple or 1 medium size orange/apple/ pear

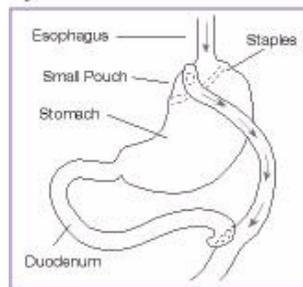
**Appendix 7.1 : Surgical interventions in obesity (Evidence Level B)**

Figure 3



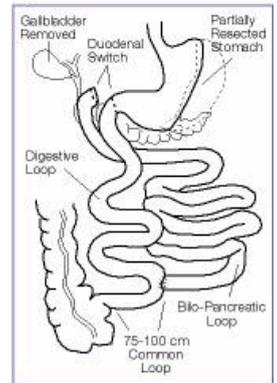
Vertical Gastric Banding

Figure 4



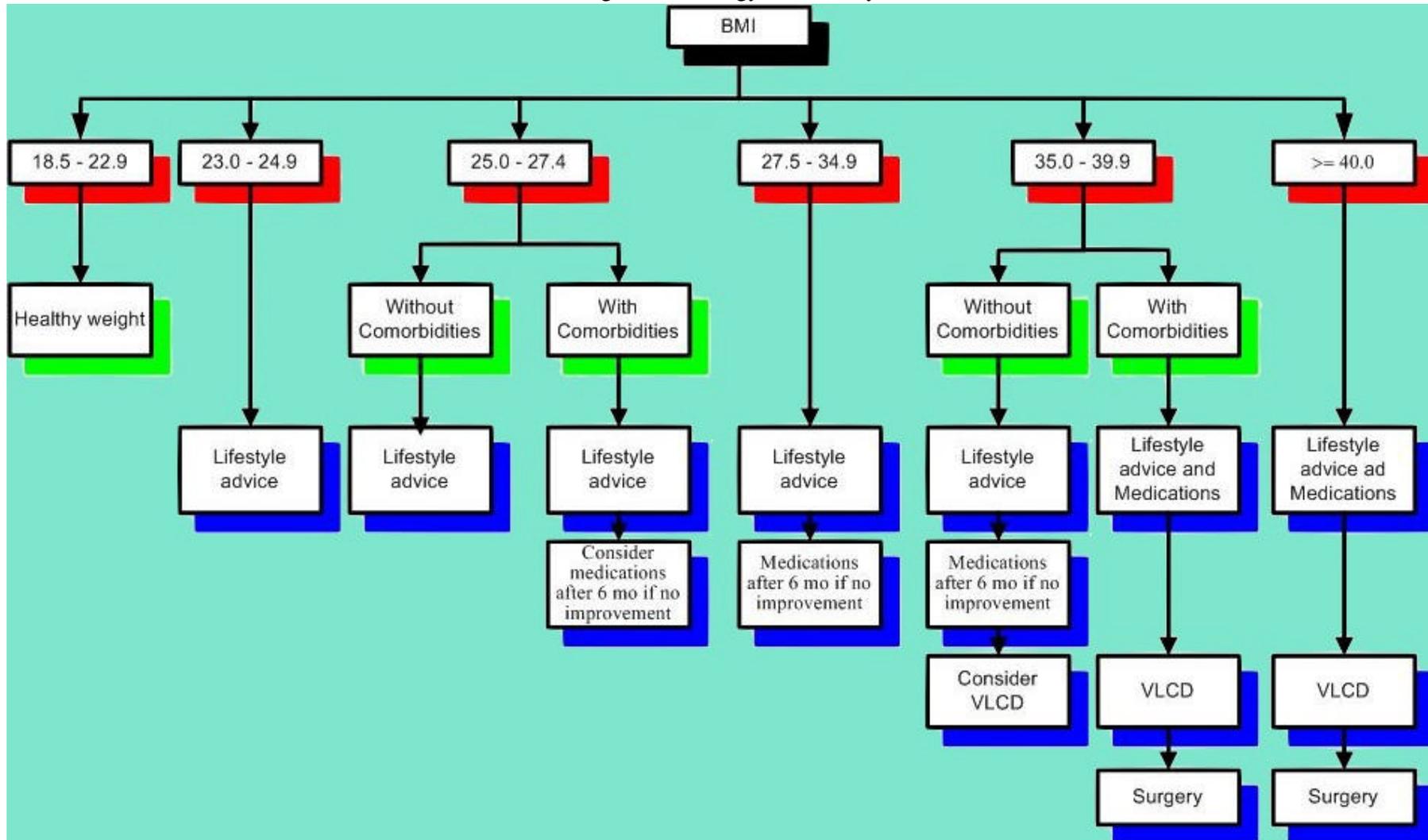
Roux-en-Y

Figure 6



Bilio-Pancreatic Bypass Procedure

## Management Strategy for Obesity



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