



OBESITY

Objectives:

- Introduction- definition
- Etiology – secondary causes of obesity
- Pathophysiology
- Control of appetite
- Complications & Conditions
- Differential diagnosis
- Laboratory studies
- Fat distribution
- Management
- Prevention



INTRODUCTION

Introduction

- ❖ **Obesity is a condition characterized by an excess of body fat.**
- ❖ **Obesity can be considered to result from an imbalance between the amount of energy consumed in the diet and the amount of energy expended through exercise and bodily functions.**
- ❖ **People who are obese are more likely to develop a range of chronic conditions.**
- ❖ **In 2006, the number of obese and overweight people surpassed numbers of malnourished and underweight people.**

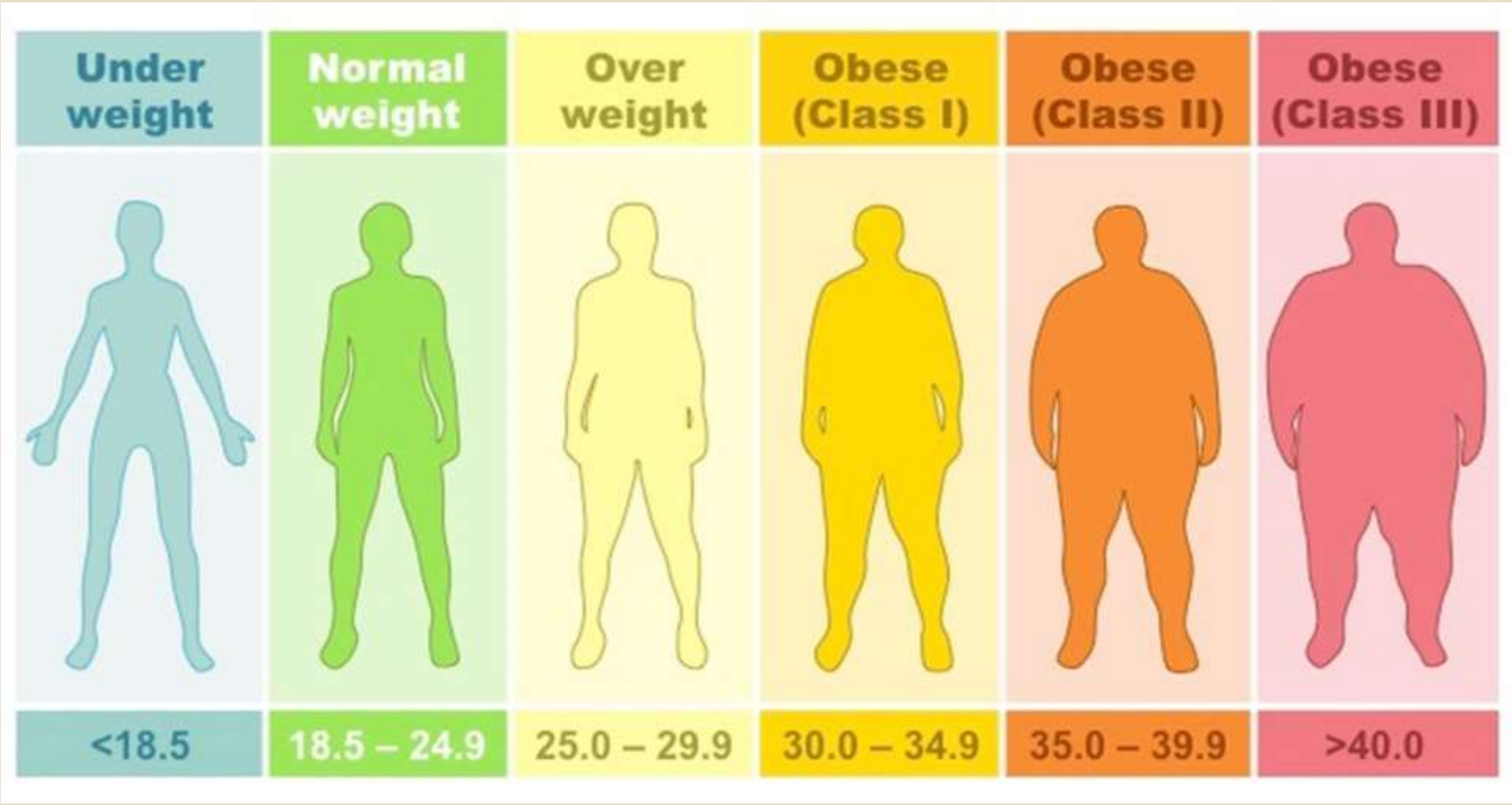
Introduction

- ❖ It is now widely accepted that we cannot blame the current obesity epidemic on individual behavior and poor choice.
- ❖ The best way, therefore, to understand the current obesity epidemic is to consider humans as ‘obesogenic organisms’ who, for the first time in their history, find themselves in an obesogenic environment-that is, one where people’s circumstances encourage them to eat more and exercise less. This includes the availability of cheap and heavily marketed energy-rich foods, the increase in labour-saving devices (e.g. lifts and remote controls) and the increase in passive transport (cars as opposed to walking, cycling, or walking to public transport hubs)
- ❖ We are stuck with the metabolic and behavioral legacy of our evolutionary history – we are organisms that are programmed to eat when we can and preserve energy whenever possible.

Introduction

Although several classifications and definitions for degrees of obesity are accepted, the most widely accepted classifications are those from the World Health Organization (WHO), based on body mass index (BMI). The WHO designations are as follows:

WHO classification	BMI (kg/m ²)	Risk of co-morbidities
Overweight	25–30	Mildly increased
Obese	>30	
Class I	30–35	Moderate
Class II	35–40	Severe
Class III	>40	Very severe



Introduction

Some authorities advocate a definition of obesity based on percentage of body fat, as follows:

- ❖ Men: Percentage of body fat greater than 25%
- ❖ Women: Percentage of body fat great than 33%



**World
Obesity
Day** 4 March
2021

**EVERY
BODY
NEEDS
EVERYBODY**





ETIOLOGY

Etiology:

what causes obesity ?

The etiology of obesity is far more complex than simply an imbalance between energy intake and energy output.

Possible factors in the development of obesity include the following:

➤ **Level of activity**

Decreases in the level of activity

➤ **Dietary habits**

➤ **Metabolic factors**

➤ **Socioeconomic status**

➤ **Smoking cessation**

➤ **Genetic factors**

➤ **Endocrine factors**

➤ **Psychological factors**

➤ **Race, sex, and age factors**

➤ **Pregnancy and menopause**

ETIOLOGY

Genetic factors:

Recent results from 'genome-wide' association studies have identified a handful of genes that influence **obesity**, some of which encode proteins known to be involved in the **control of appetite** or **metabolism** and some of which have unknown function, such as:

- Mutations of the **melanocortin-4 receptor (MC4R)**,
- Defects in the enzymes processing **proopiomelanocortin (POMC)**
- Mutations in the **leptin** gene

However, these genes account for less than 5% of the variation in body weight

Secondary causes of obesity

Endocrine causes:

Hypothyroidism

↓Energy expenditure

Cushing disease

Fat tissue modulation

Polycystic ovaries

Growth hormone deficiency

↑Fat deposition

Hypothalamic obesity

Energy balance disruption

Hypogonadism

low testosterone levels exacerbate male obesity, facilitating adipose tissue deposition in visceral sites

Insulinoma

↑Energy intake

Genetic causes

Leptin and leptin receptor
deficiency

POMC deficiency

Melanocortin Receptor 4
deficiency

Prohormone convertase
deficiency

BDNF and TrkB
insufficiency

SIM 1 insufficiency

Drug causes

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graph LR; A[Drug causes] --- B[Antipsychotics]; A --- C[Drugs for diabetes]; A --- D[Antidepressant]; A --- E[Drugs for epilepsy]; A --- F[Steroid hormone]; A --- G[beta-blockers]
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Antipsychotics

Drugs for diabetes

Antidepressant

Drugs for epilepsy

Steroid hormone

beta-blockers

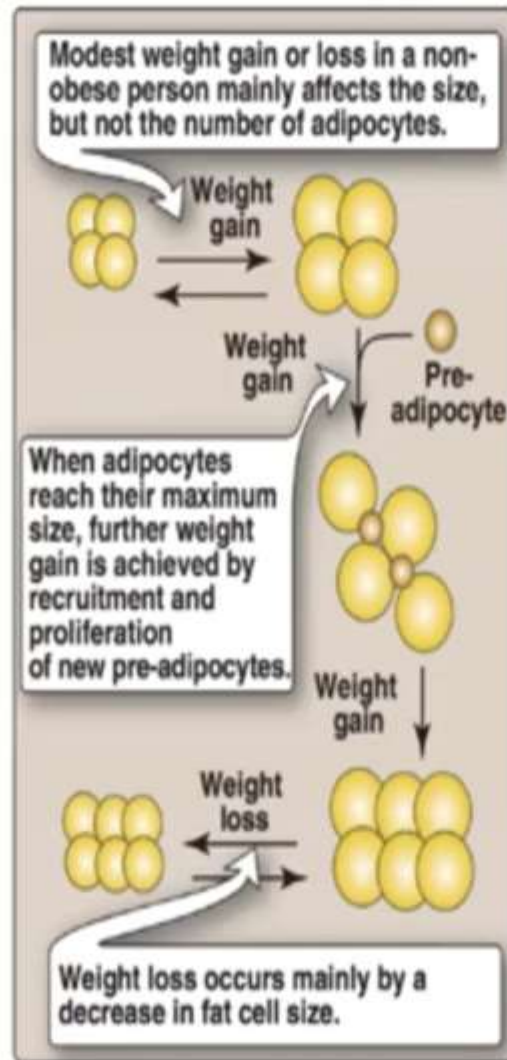
Drugs

- ❑ Centrally acting medications : Antipsychotics, antidepressants and antiepileptics can increase body weight, probably through their effect on the monoamines in the CNS
- ❑ Anti-diabetic medications: In Study , **treatment of diabetic patients with insulin and sulfonylureas**, and not metformin, **resulted in an average weight gain** of 4.8 kg in 3 years. The effect of insulin is usually associated with increased hunger and appears to be dose-dependent .**A potential explanation of the weight gain with insulin is the improved utilization of calories through a decrease in glycosuria.**
- ❑ Weight gain can occur as a side effect of some beta blockers



PATHOPHYSIOLOGY

What happen to adipocytes in response to increased fat intake?



PATHOPHYSIOLOGY

The adipocyte, which is the cellular basis for obesity, may be increased in size or number in obese persons.

❖ Hypertrophic Obesity

characterized by enlarged fat cells, usually starts in adulthood, is associated with increased cardiovascular risk, and responds quickly to weight reduction measures.

❖ Hypercellular Obesity

typically occurs in persons who develop obesity in childhood or adolescence. patients with hypercellular obesity may find it difficult to lose weight through nonsurgical interventions.



CONTROL OF APPETITE

Appetite is the desire to eat and this usually initiates food intake. Following a meal, satiation occurs.

Following a meal, the following hormones are secreted from the intestines:

1. cholecystokinin (CCK)
2. Bombesin
3. glucagon-like peptide 1 (GLP-1)
4. Enterostatin
5. Somatostatin

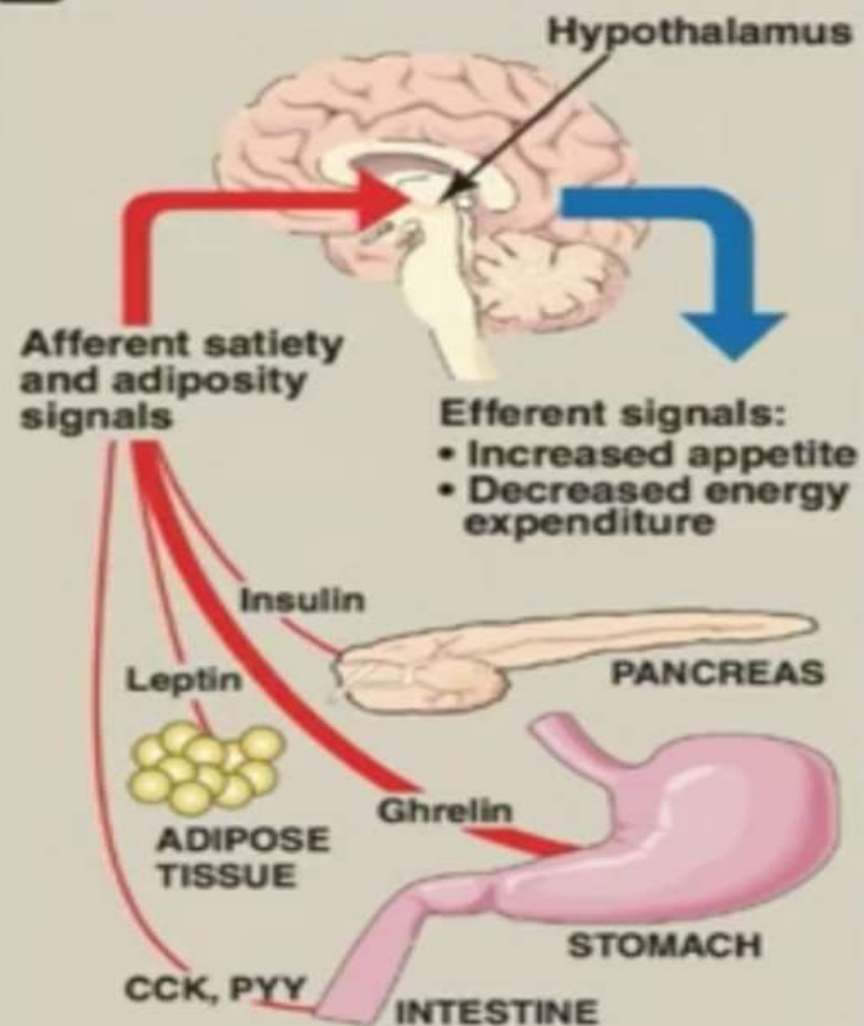
glucagon and insulin are secreted from the pancreas

All of these hormones have been implicated in the control of satiety.

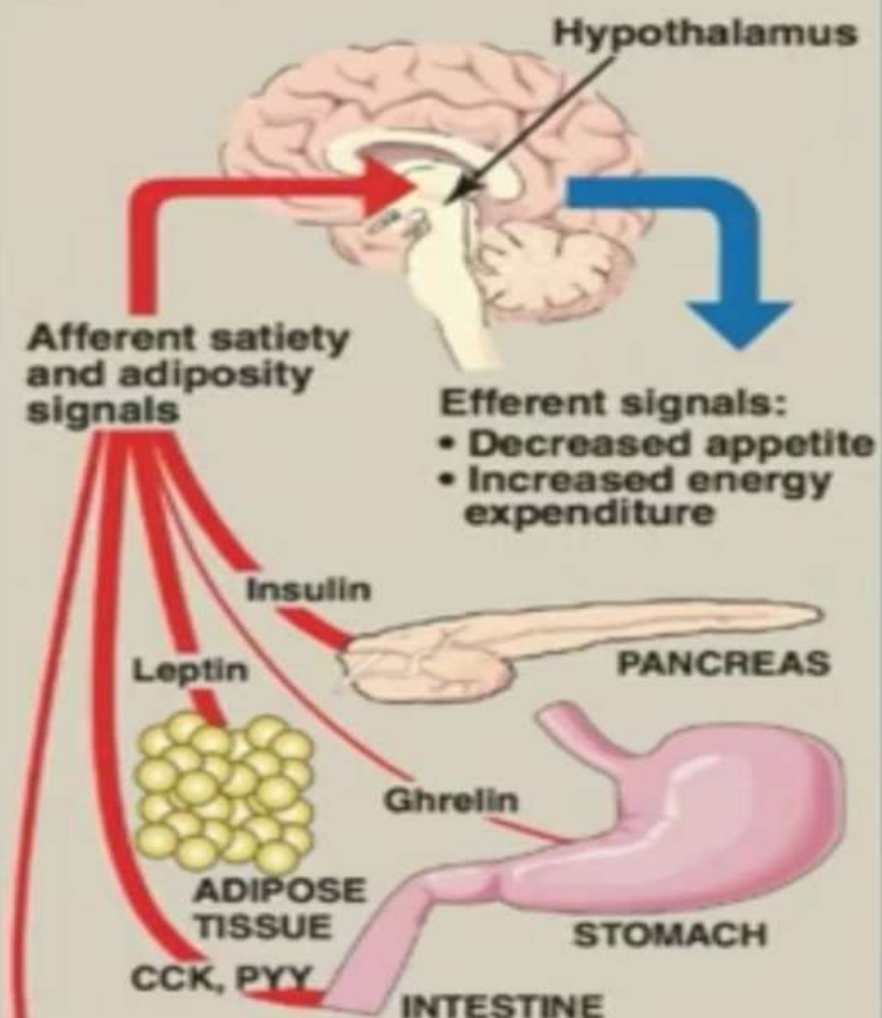
Control of appetite

- ❖ **Centrally:** the hypothalamus – particularly the lateral hypothalamic area and paraventricular and arcuate nuclei – plays a key role in integrating signals involved in appetite and body weight regulation
- ❖ **Peripheral **appetite-suppressing** signals:**
Leptin and insulin act centrally to activate the appetite-suppressing pathway
- ❖ **Peripheral **appetite-stimulating** signals :**
Ghrelin is produced by the oxyntic cells of the fundus of the stomach. It stimulates appetite by activating the central appetite-stimulating pathway.
The circulatory concentration is high before a meal and is reduced rapidly by ingestion of a meal or glucose

A Undernourished



B Overnourished



Other factors (such as the availability of palatable, energy-dense foods, poor food choices) mediated by complex neural pathways

Adipocytes & its secretions

The adipocyte is increasingly found to be a complex & metabolically active cell.

Many of the adipocytokines secreted by adipocytes are proinflammatory or play a role in blood coagulation. Others are involved in insulin sensitivity and appetite regulation.

- *Leptin*

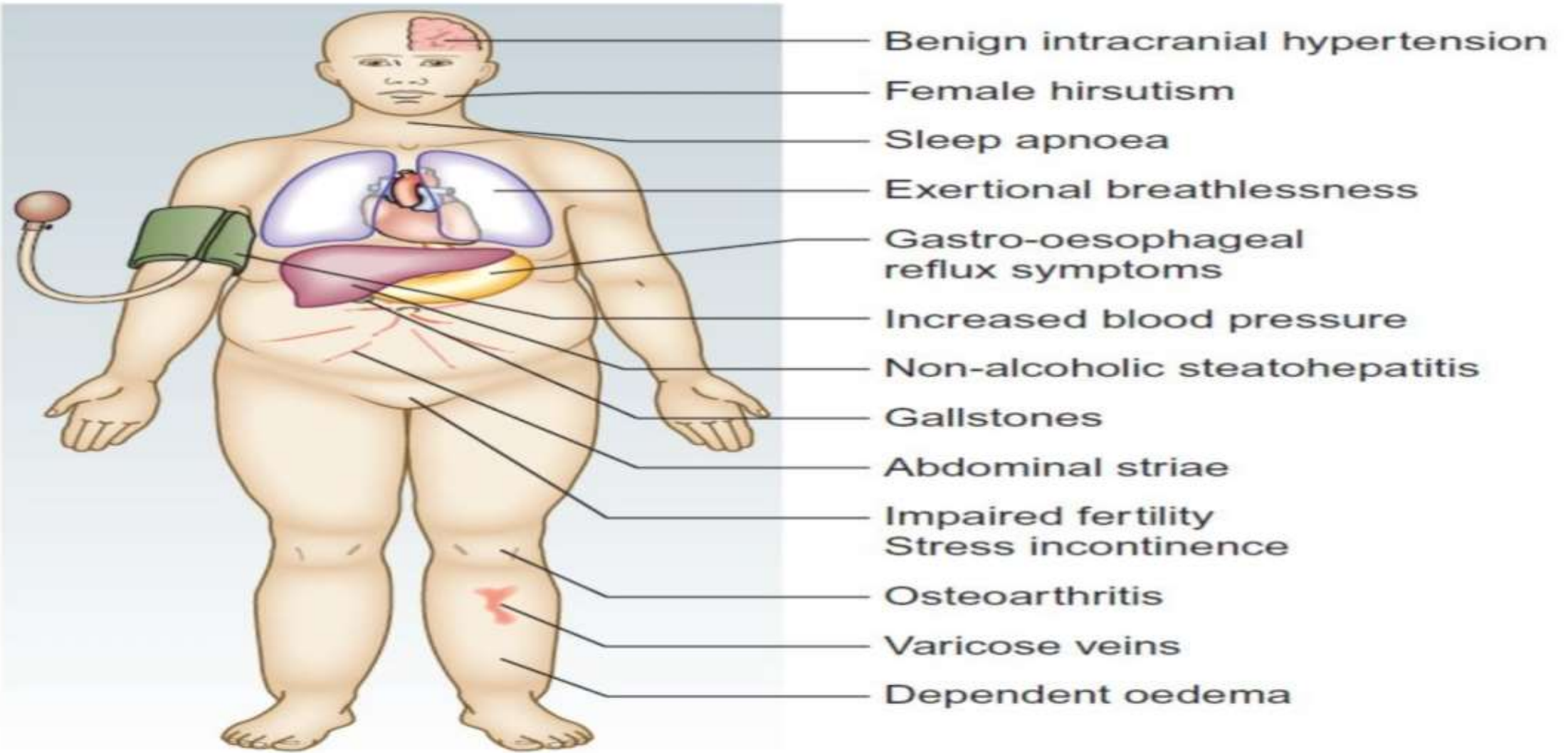
- The major role of leptin in body-weight regulation is to signal satiety to the hypothalamus and thus reduce food intake and fat storage while modulating energy expenditure and carbohydrate metabolism, preventing further weight gain.
- Most humans who are obese are not leptin deficient but are instead **leptin resistant**.
- Therefore, they have elevated levels of circulating leptin. Leptin levels are higher in women than in men and are strongly correlated with BMI.



CONDITIONS AND
COMPLICATIONS ASSOCIATED
WITH OBESITY

- Osteoarthritis of knee and hips
- Varicose veins
- Hiatus hernia
- Gallstones
- Back strain
- Accident proneness
- Obstructive sleep apnoea
- Hypertension
- Heart failure
- Cancer risk

- Breathlessness
- Ischemic heart disease
- Stroke
- Diabetes mellitus (type 2)
- Hyperlipidemia
- Menstrual abnormalities
- Increased morbidity and mortality (the greater the obesity, the higher morbidity and mortality rates. For example, men who are 10% overweight have a 13% increased risk of death, while the increase in mortality for those 20% overweight is 25%)



- Benign intracranial hypertension
- Female hirsutism
- Sleep apnoea
- Exertional breathlessness
- Gastro-oesophageal reflux symptoms
- Increased blood pressure
- Non-alcoholic steatohepatitis
- Gallstones
- Abdominal striae
- Impaired fertility
- Stress incontinence
- Osteoarthritis
- Varicose veins
- Dependent oedema

Complications of obesity.

Source : Macleods Clinical Examination 13th Ed (2013)

Conditions to consider while examining for obesity :

- Polycystic ovarian disease (PCOS)
- Depression
- Type 2 diabetes mellitus
- Cushing syndrome
- Insulinoma
- Fatty liver
- Hypothyroidism



LABORATORY STUDIES

❖ **Fasting lipid panel:** a blood test that measures lipids—fats and fatty substances used as a source of energy by a human body. Lipids include Cholesterol, triglycerides, high-density lipoprotein(HDL) cholesterol, and low-density lipoprotein (LDL) cholesterol.

This panel measures:

- ✓ Total cholesterol level.
- ✓ Triglyceride level.
- ✓ HDL cholesterol level. This is the "good" cholesterol.
- ✓ LDL cholesterol level. This is the "bad" cholesterol.
- It is used to detect and prevent lipid disorders
- FOR INSTANCE, Hypercholesterolemia (high cholesterol level in blood) may lead to life threatening illnesses such as coronary artery disease(CAD), heart attack, or stroke.

❖ **Liver function studies:**

- Liver function test: yields normal results in most obese patients. However, elevated transaminase levels may indicate non-alcoholic steatohepatitis (NASH) or fatty infiltration of the liver.

❖ **Thyroid function tests:** Thyroid function test results are also typically normal, but checking them to detect **primary hypothyroidism**.

❖ **Fasting blood glucose and hemoglobin A1c**

(HbA1c): Obesity is associated with insulin resistance and increased serum levels of fasting insulin and C-peptide serum levels. This test should be done to exclude diabetes.

❖ **24-hour urinary free-cortisol test;** is needed only when Cushing syndrome or other hypercortisolemic states are clinically suspected.

An electrocardiogram: should be done in view of the high prevalence of hypertension and cardiovascular disease in obesity.

Evaluation of degree of fat

- Common measures of the degree of body fat used in routine clinical practice include:

1) Body mass index (BMI) calculation

2) Waist circumference, and waist/hip ratio.

- another procedure that is used in few clinical centers is:

Caliper-derived measurements of skin-thickness.

BODY MASS INDEX (BMI).

- Is a person's weight in kilograms divided by the square of height in meters.
- An Inexpensive and easy screening method for weight category (underweight, healthy weight, overweight, and obesity.).
- BMI does not describe body fat distribution.

HOW TO CALCULATE BODY MASS INDEX

$$BMI = \frac{\textit{Weight (kg)}}{[\textit{Height(m)}]^2}$$



3.13 The relationship between body mass index (BMI), nutritional status and ethnic group

	BMI non-Asian	BMI Asian
Severe malnutrition	<16	<16
Underweight	<18.5	<18.5
Normal	18.5–24.9	18.5–22.9
Overweight	25–29.9	23–24.9
Obese	30–39.9	25–29.9
Morbidly obese	≥40	≥30

Waist circumference

- **Waist circumference:**
- Health risk is increased when waist circumference exceeds 94 cm (37 inches) for men and 80 cm (32 inches) for women.
- Waist : hip ratio is strongly related to risk of coronary artery disease.
- $WHR = \frac{WAIST\ CIRCUMFERENCE}{HIP\ CIRCUMFERENCE}$.

How to Calculate Waist-Hip Ratio

INSTRUCTIONS

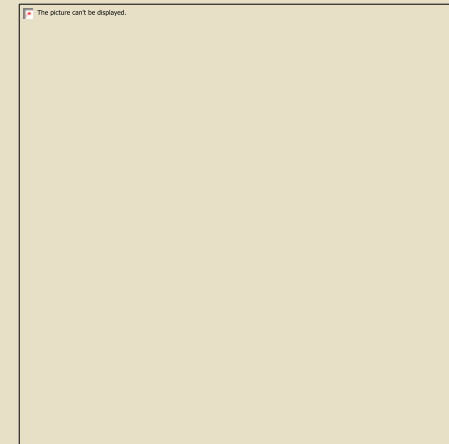
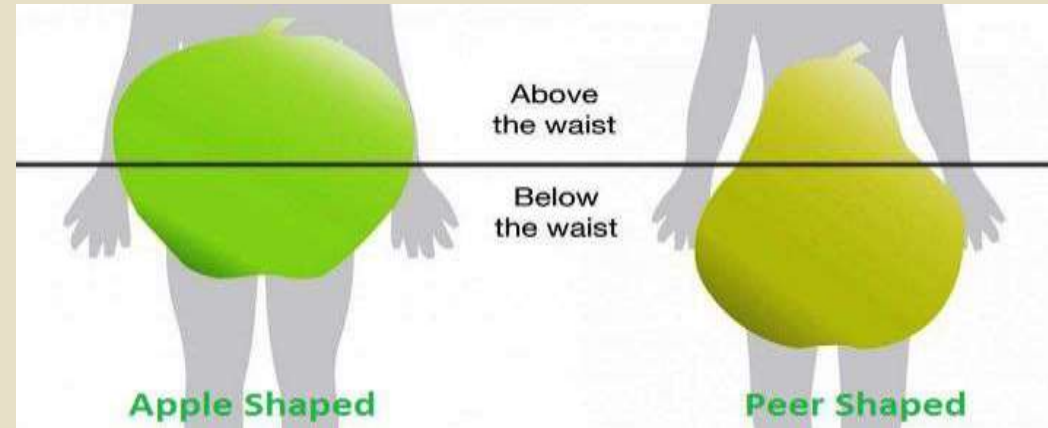
1. Measure your waist – just under your lowest rib.
2. Measure your hips – at the widest portion of your buttocks.
3. Divide waist measurement by hip measurement to get the ratio.

For women, the ratio should be less than 0.85



Waist to hip ratio

- Apple shape: has a larger waist and carry a lot of weight around their abdomen.
- ‘Apple shaped’ subjects with a greater waist : hip ratio have an increased risk of coronary artery disease and the metabolic syndrome.
- Pear shape: has a larger hip and a smaller waist.
- ‘Pear shape’ and a waist : hip ratio of 0.8 or below in females or < 0.9 in males have a good prognosis.



SKINFOLD MEASUREMENTS:

- Skinfold caliper is used to assess the skinfold thickness, so that a prediction of the total amount of body fat can be made. This method is based on the hypothesis that the body fat is equally distributed over the body and that the thickness of the skinfold is a measure for subcutaneous fat.

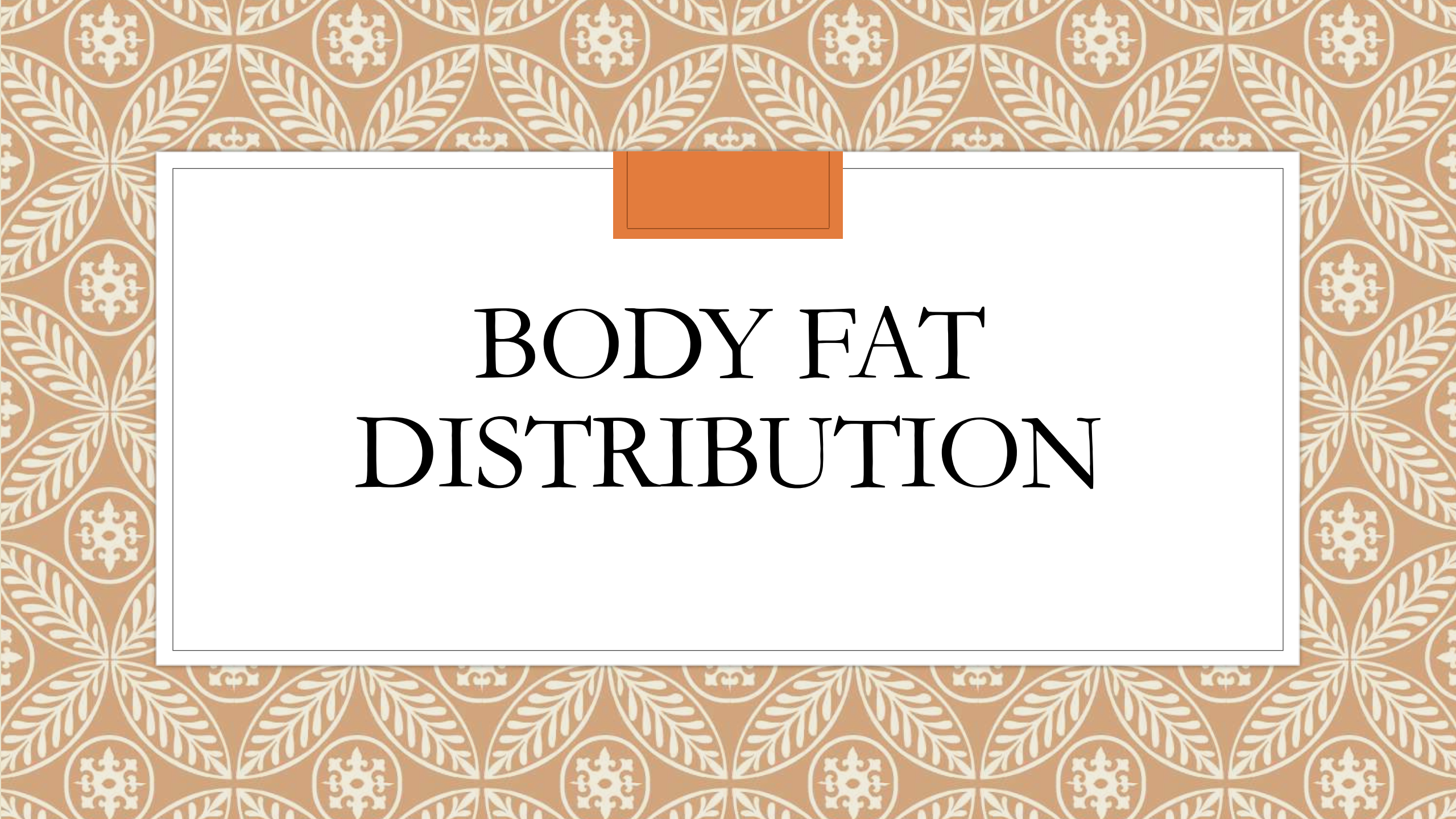


The sum of four skinfolds:

To estimate the total amount of body fat, four skinfolds are measured:

- Biceps skinfold (front side middle upper arm).
- Triceps skinfold (back side middle upper arm).
- Subscapular skinfold (under the lowest point of the shoulder blade).
- Suprailiac skinfold (above the upper bone of the hip).

◦ For this measurement, the patient must be able to sit or stand in an upright position. Skinfold measurements are cheap, non-invasive and easy to perform, although practice is required. With the table of Durnin en Womersly (1974), the percentage of body fat can be read by a given age and sex. This table contains data for people aged 17 years and older.



BODY FAT DISTRIBUTION

The distribution rather than the absolute amount of excess adipose tissue appears to be important.

Increased intra-abdominal fat causes 'central' ('abdominal or 'apple-shaped') obesity. More common in men.

Subcutaneous fat accumulation causes 'generalized' ('gynoid' or 'pear-shaped') obesity. More common in females.

Body fat distribution

- The key difference between these depots of fat may lie in their vascular anatomy, with intra-abdominal fat draining into the portal vein and thence directly to the liver.
- Thus many factors that are released from adipose tissue (including free fatty acids; ‘adipokines’, such as tumor necrosis factor- α , adiponectin and resistin; and steroid hormones)
- May be at higher concentration in the liver and hence induce insulin resistance and promote type 2 diabetes



MANAGEMENT



Treatment of obesity starts with **comprehensive lifestyle management** which should include the following :



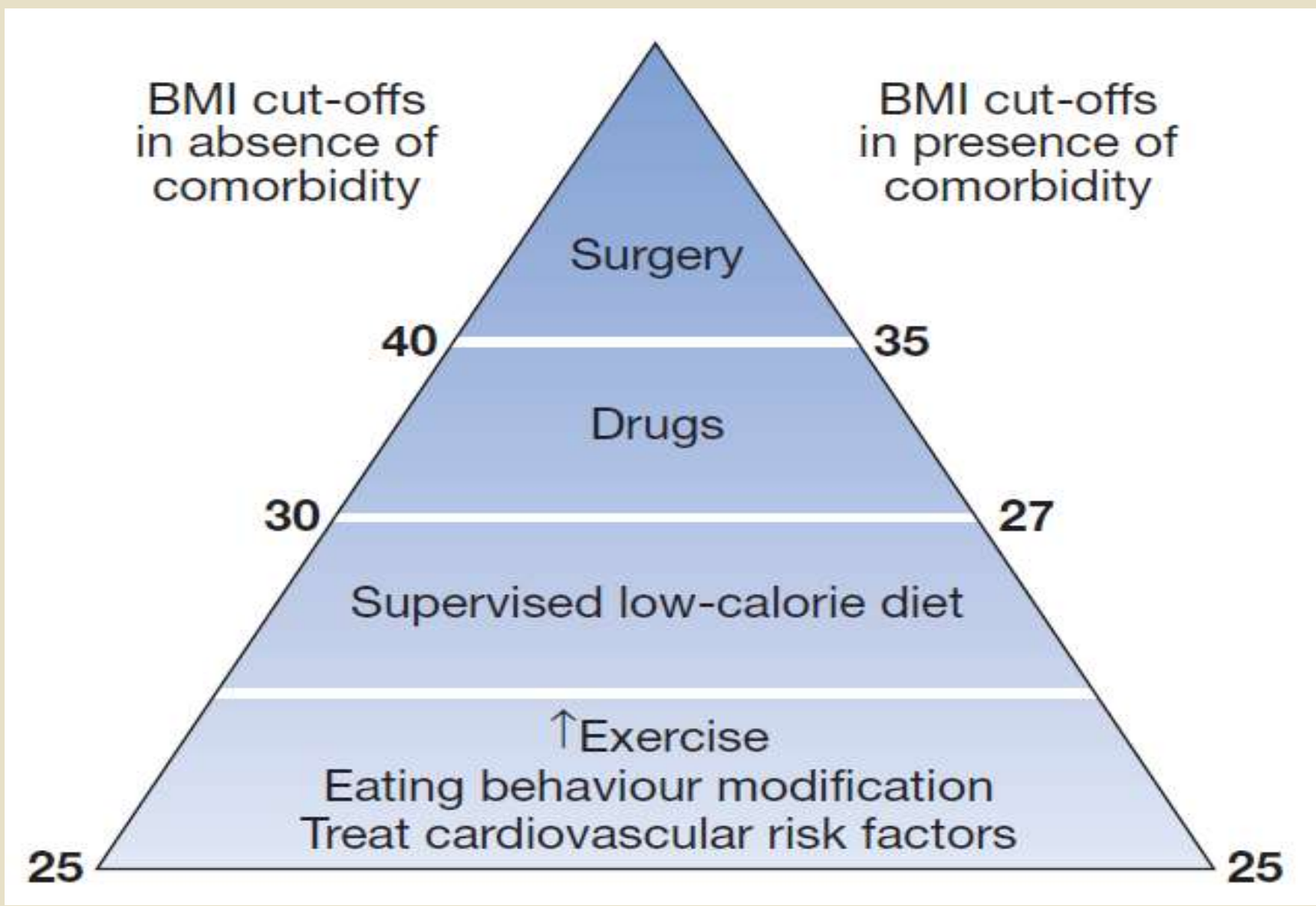
Behavioural modification
(diet, physical activity)



Drug therapy



Surgical management





Dietary control



This largely depends on the reduction of calorie intake. Weight loss **initially** will be great owing to accompanying protein and glycogen breakdown along with consequent water loss.



After 3-4 weeks weight loss may be very small because only adipose tissue is broken down and there is less accompanying water loss.



A balanced diet from a nutritionist is advised

Exercise

- Aerobic isotonic exercise is of the greatest value for persons who are obese. The ultimate minimum goal should be to achieve 30-60 minutes of continuous aerobic exercise 5-7 times per week.
- Increased physical activity and exercise 300 min/week is associated with significant weight reduction and longer maintenance of the weight loss



PRESCRIPTION MEDICATIONS

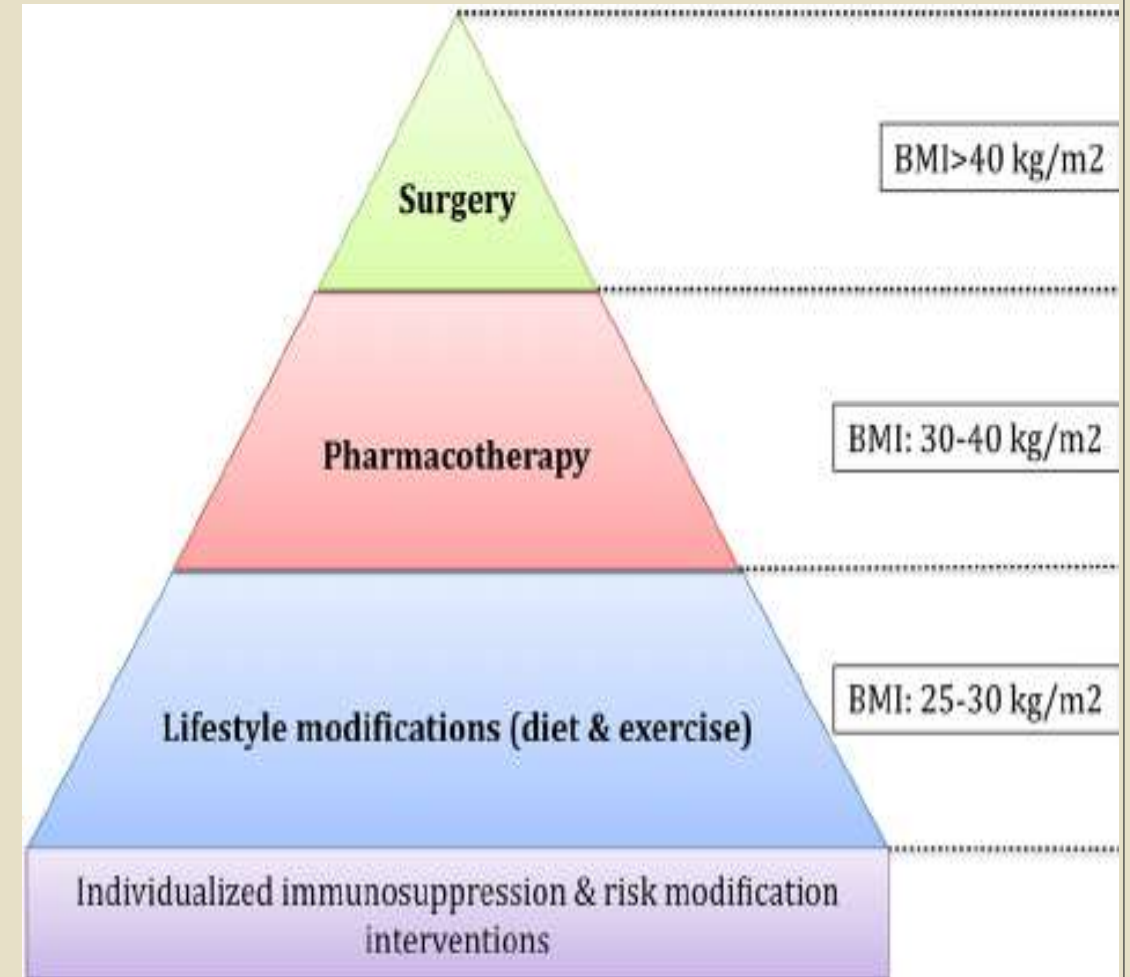


Weight-loss medications	Mechanism of action	Common Side Effects
Orlistat	Work on gut to reduce the amount of fat absorbed.	Diarrhea Gas Stomach pain
Lorcaserin	Acts on serotonin receptors to make you feel full	Constipation Cough Dizziness headache
Phentermine-topiramate	Lessens your appetite	Constipation Dizziness Dry mouth
Naltrexone-bupropion	Help feel less hungry and full sooner.	Constipation, hypertension, may increase suicidal thoughts
Liraglutide	Make you feel less hungry	Nausea, abdominal pain and headaches ,increased risk of pancreatitis

Surgical management of obesity

Surgery is now performed laparoscopically in patient with morbid obesity with a :

- BMI of **>40** kg per m²
- or in patients with **BMI >35** kg per m² with obesity related **complication** after conventional medical treatment has failed .
- it is **1st line** treatment with patients with BMI greater than **50** kg per m².



surgery

Some centres may insert a balloon into the stomach to initiate weight loss prior to bariatric surgery for **morbid obesity**.

Removing a gastric balloon in new zarqa govermental hospital last week during our rotation



A variety of gastrointestinal surgical procedures are used

- **Restrictive procedures**
- **Malabsorption procedure**
- **Combination of Malabsorptive and restrictive procedures**
- **Liposuction**

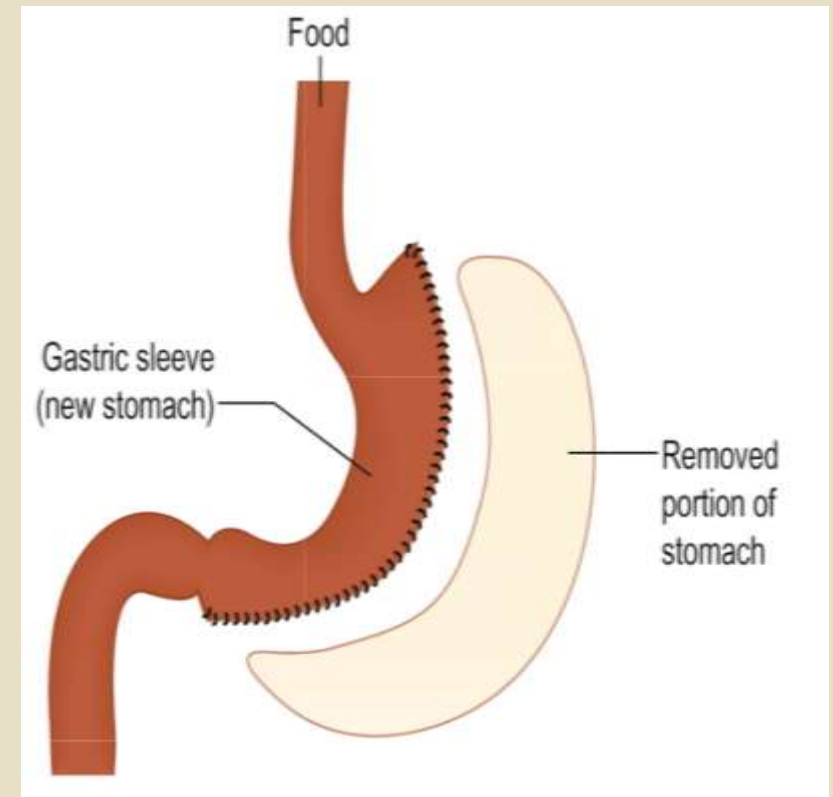
Restrictive procedures

limits caloric intake by
reducing the stomachs reservoir capacity.

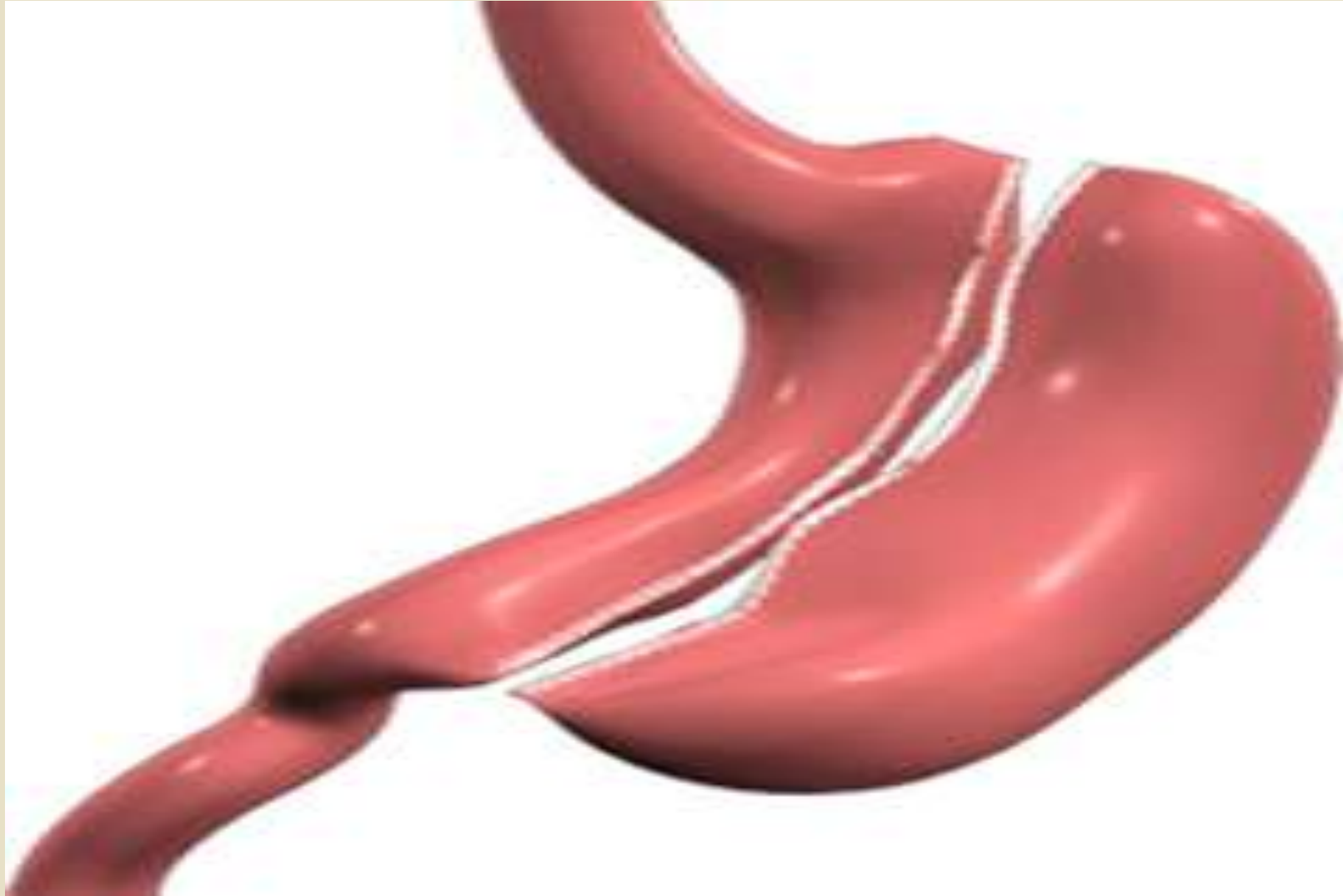
examples includes:

1. Gastric sleeve

In this procedure, part of the stomach is removed, creating a smaller reservoir for food. It's a less complicated surgery than gastric bypass or biliopancreatic diversion with duodenal switch.



Sleeve Gastrectomy



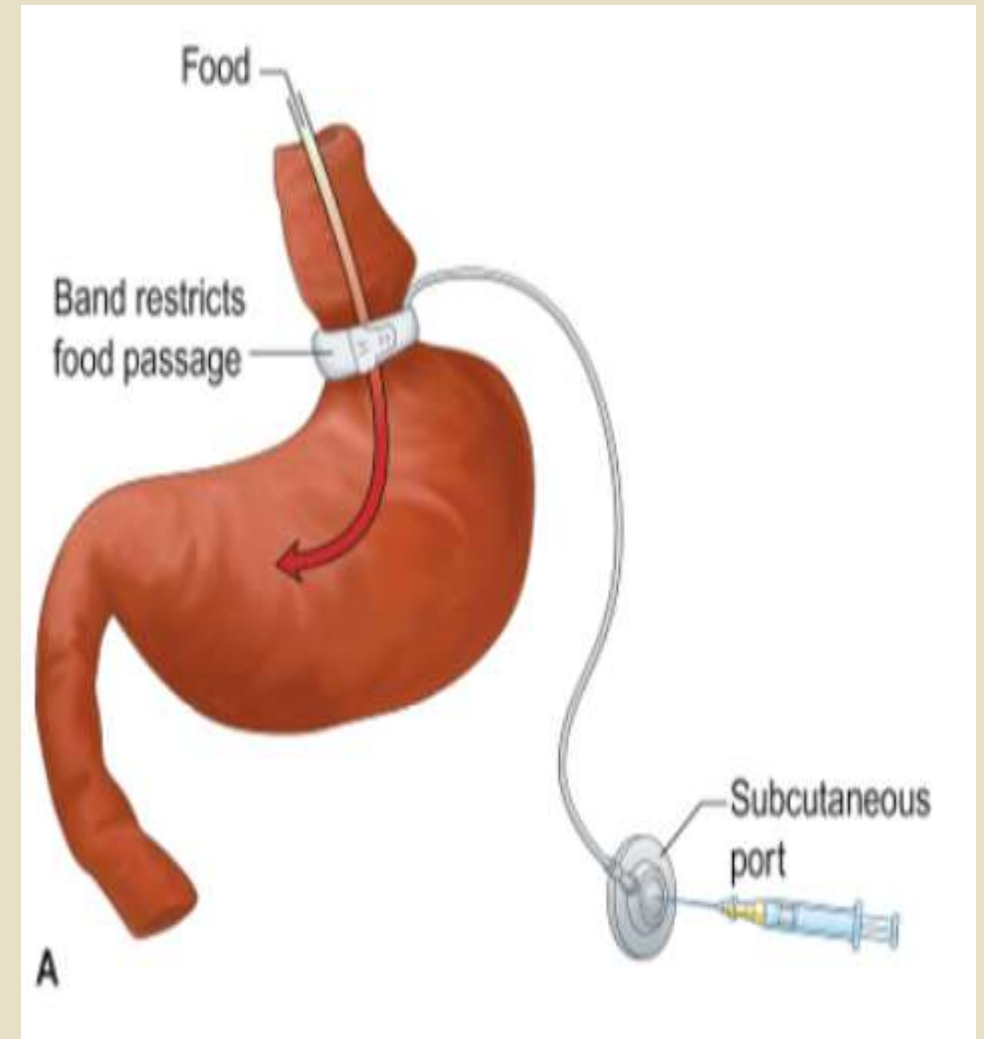
Sleeve Gastrectomy



2. Laparoscopic adjustable gastric banding (LAGB)

This procedure includes separating the stomach into two pouches with an inflatable band.

By pulling the band tight, like a belt, the surgeon creates a tiny channel between the two pouches. The band keeps the opening from expanding and is generally designed to stay in place **permanently**.



Malabsorption procedure

These procedures decrease the effectiveness of nutrient absorption by shortening the length of the functional small intestines.

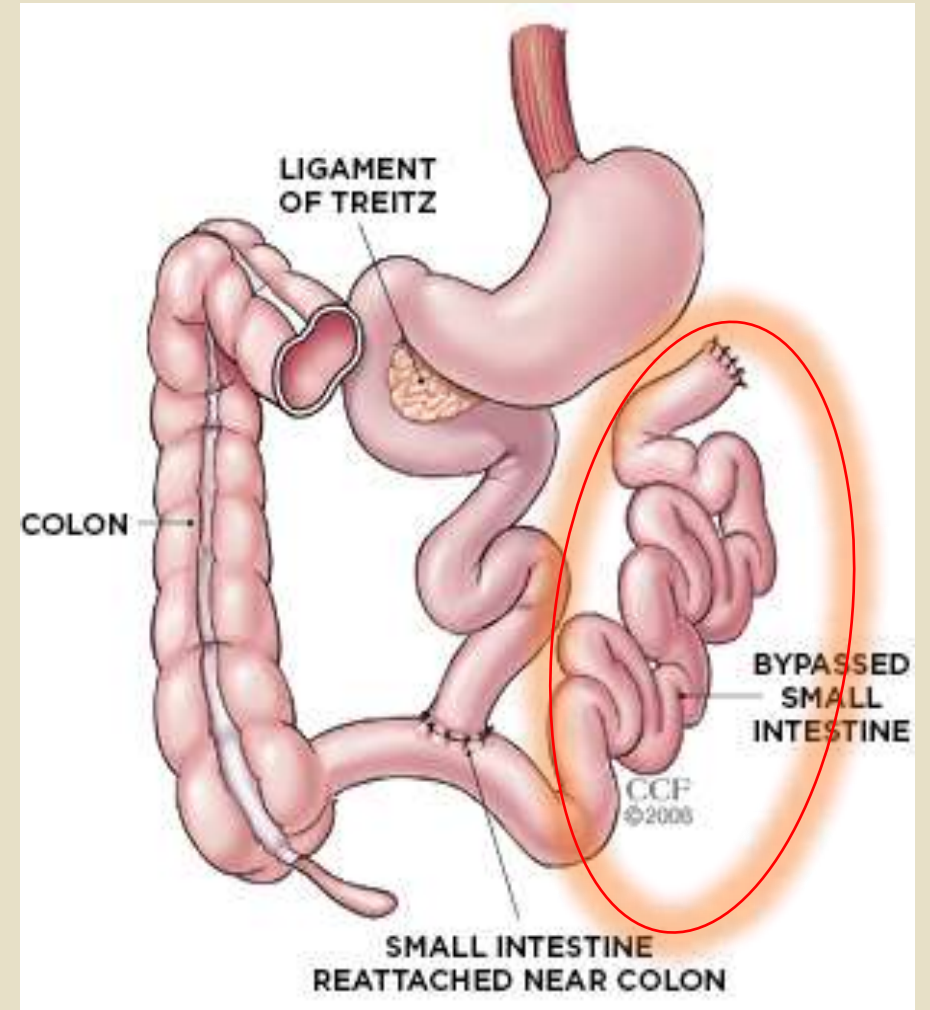
An example on this is:

- Jejunioileal bypass

the proximal (15 in.) of the jejunum is anastomosed to the proximal of distal terminal ileum resulting in small area for absorption and digestion

The benefits of weight loss of this procedure can be **offset** by significant metabolic complications such as

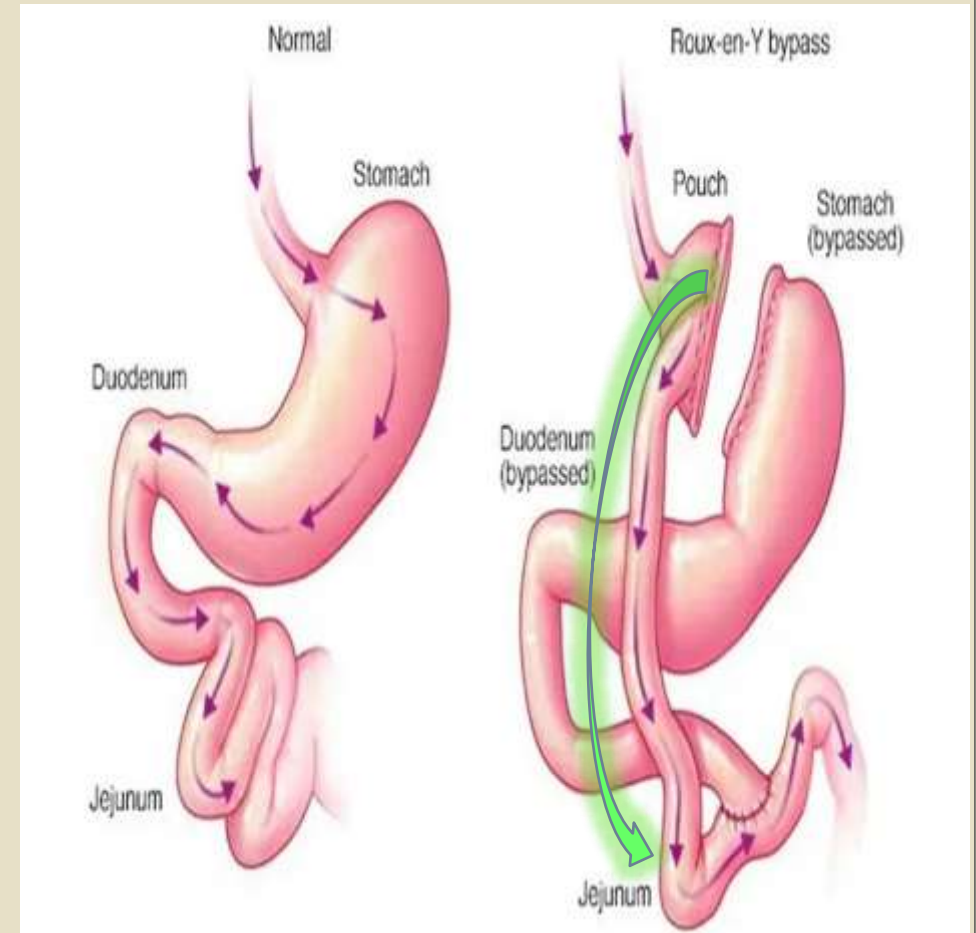
- **protein calorie malnutrition**
- **micronutrient deficiencies.**



Combination of Malabsorptive and restrictive procedures

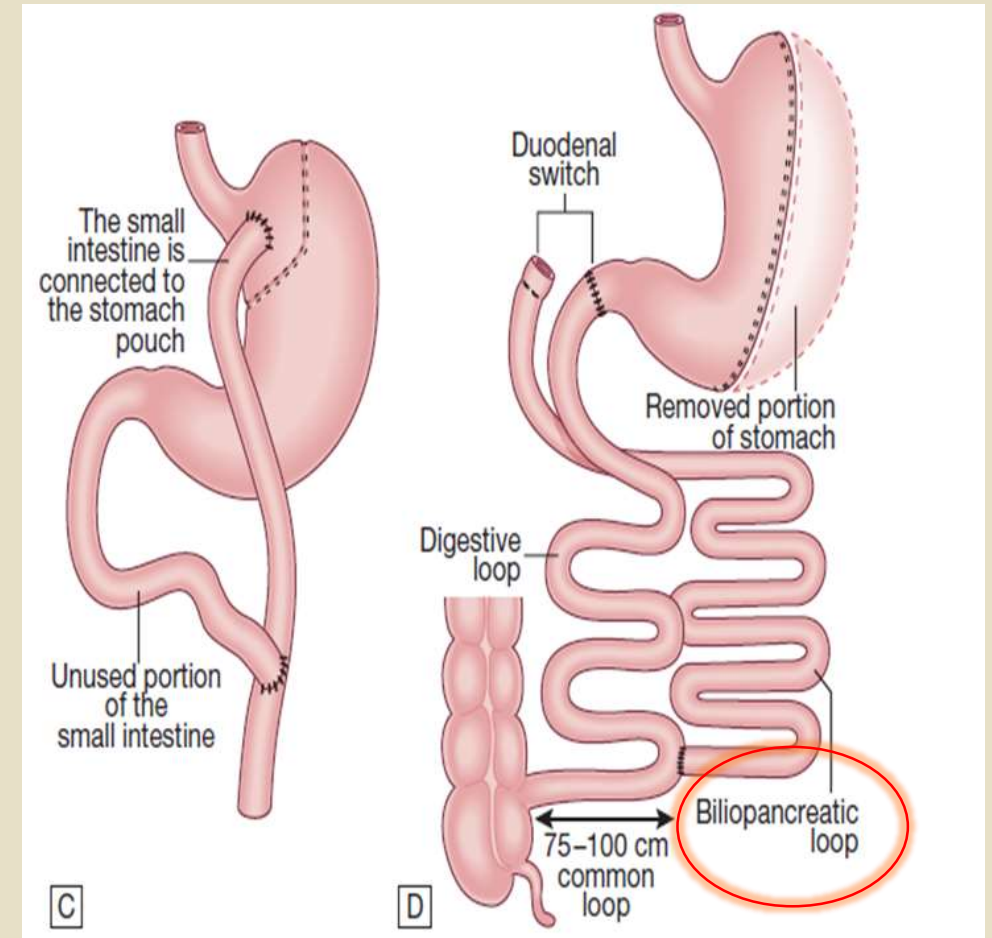
1. **Roux-en-Y gastric bypass:**

characterised by a small proximal gastric pouch that is divided and separated from the distal stomach and anastomosed to a roux limb of the small bowel. Food and liquid flow directly from the pouch into this part of the intestine, bypassing most of the stomach.



2. Biliopancreatic diversion with duodenal switch

- The first step is sleeve gastrectomy
 - The second step bypasses the majority of the intestine by connecting the end portion of the intestine to the duodenum near the stomach
- The procedures cause:
nutrient deficiencies, malnutrition and in some cases, anastomotic leaks and the dumping syndrome (e.g. with the duodenal switch).



Liposuction

■ The removal of large amounts of fat by suction (liposuction), does not deal with the underlying problem and **weight regain** frequently occurs. There appears to be no reduction in cardiovascular risk factors with the procedure.



MALE LIPOSUCTION BEFORE & AFTER

Prevention

- Preventing obesity must always be the goal because most obese people find it difficult to maintain any weight loss they have managed to achieve. All health professionals must be aware of the dangers of obesity and encourage children, and young as well as older adults, from gaining too much weight

Prevention

- Since the present obesity epidemic has resulted from **lifestyle changes**, it is appropriate to promote lifestyle changes, not only as the first-line therapy for most overweight and obese individuals, but also in the prevention of overweight and obesity.
- **Lifestyle modification** should involve reduction in the amount of time spent watching television and using computers, and encouraging the use of bicycle paths, dietary changes and educational activities for patients, parents and children.
- To prevent long-term weight gain after any of the therapies discussed above, each therapy should be part of a package that involves lifestyle modification

- **References**

- 1. Kumar and Clark's Clinical Medicine 9th edition**
- 2. Davidson's Principles and Practice of Medicine 22nd edition**
- 3. www.medscape.com**

THANK YOU

- **Oraib siam**
- **Layan salameh**
- **Dana sawalha**
- **Hala qawasmeh**
- **Abdulrahman almutairi**
- **Lian hyari**