Team Medicine

16# Obesity

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· Slides · Doctors notes · Additional

431 Teams
medical students

Objectives:

-Definition
-Pathogenesis of obesity
-Factors predisposing to obesity
-Complications of obesity
-Assessment and screening of obesity
-Management of obesity

Obesity is one of the most common non-communicable diseases.

What Is Obesity?

-Obesity means excess accumulation of fat in the body
-20% or more over an individual's ideal body weight
-Once it develops it is difficult to 'cure' and usually persists throughout life.
So, if your body weight is more than your normal BMI by 20% you're considered obese.

Obesity is usually diagnosed on the basis of calculation of:

- Body mass index
- Measurement of waist-hip ratio

Obesity…once it happens… it's difficult to be treated

Obesity Classification:

BMI: Exam Question (the BMI Formula)

BMI Calculation (kg/m2):

$$\frac{\text{Weight (kg)}}{\text{Height squared (meters)}}$$

Classification of overweight and obesity by BMI, waist circumference, and associated disease risk

	BMI kg/m^2	Obesity class	Disease risk* relative to normal weight and waist circumference	
			Men ≤102 cm (≤40 in)	>102 cm (>40 in)
			Women ≤88 cm (≤35 in)	>88 cm (>35 in)
Underweight	<18.5		-	-
Normal•	18.5-24.9		-	-
Overweight	25.0-29.9		Increased	High
Obesity	30.0-34.9	I	High	Very High
	35.0-39.9	II	Very High	Very High
Extreme Obesity	≥40	III	Extremely High	Extremely High

* Disease risk for type 2 diabetes, hypertension, and CVD.
• Increased waist circumference can also be a marker for increased risk even in persons of normal weight.
Reproduced from: Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults--The Evidence Report. National Institutes of Health. Obes Res 1998; 6:515.

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Determining body mass index using kilograms and centimeters*

BMI, kg/m2	19	20	21	22	23	24	25	26	27	28	29	30	35	40
Height, cm*	Weight, kg*													
147	41	43	45	48	50	52	54	56	58	61	63	65	76	86
150	43	35	47	50	52	54	56	59	61	63	65	68	79	90
152	44	46	49	51	53	55	58	60	62	65	67	69	81	92
155	46	48	50	53	55	58	60	62	65	67	70	72	84	96
158	47	50	52	55	57	60	62	65	67	70	72	75	87	100
160	49	51	54	56	59	61	64	67	69	72	74	77	90	102
162	50	52	55	58	60	63	66	68	71	73	76	79	92	105
165	52	54	57	60	63	65	68	71	74	76	79	82	95	109
168	54	56	59	62	65	68	71	73	76	79	82	85	99	113
170	55	58	61	64	66	69	72	75	78	81	84	87	101	116
173	57	60	63	66	69	72	75	78	81	84	87	90	105	120
175	58	61	64	67	70	74	77	80	83	86	89	92	107	123
178	60	63	67	70	73	76	79	82	86	89	92	95	111	127
180	62	65	68	71	75	78	81	84	87	91	94	97	113	134
183	64	67	70	74	77	80	84	87	90	94	97	100	117	134
185	65	68	72	75	79	82	86	89	92	96	99	103	120	137
188	67	71	74	78	81	85	88	92	95	99	102	106	124	141
190	69	72	76	79	83	87	90	94	97	101	105	108	126	144
193	71	74	78	82	86	89	93	97	101	104	108	112	130	149

* The health risk from any level of BMI is increased if the patient has gained more than 5 kg (11 pounds) since age 25, or if the waist circumference is above 100 cm (40 in) due to central fatness.

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Classification of obesity as per fat distribution:

Android (Abdominal, Central, Males)

- Collection of fat mostly in the abdomen (above the waist).
- Apple-shaped.
- Associated with insulin resistance and heart disease.
- Note:
- Sometimes females can present with android type of obesity especially in case of endocrine diseases e.g. Cushing's disease.

Gynoid (Below the waist, Females)

- Collection of fat on hips and buttocks
- Pear-shaped
- Associated with mechanical problems
- Note: mechanical problems= Osteoarthritis

Obesity Prevalence:

- Well recognized as a serious and growing public health problem WHO estimates that over 750 million people around the world are overweight, 315 million are obese. *So, overweight people are more than the obese worldwide*
- Rates of obesity have tripled in the last 20 years in the developing world.
- In US, 33.3 % of men and 35 % of women are obese in 2007.
- 15-25 % of American children are obese.

In SA: study done between 1995-2000 in age group between 30-70 on 17000 subjects:

-Prevalence of overweight: 36.9 %: 42% male, 31.8 % female
-Prevalence of obesity: 35.5 % , severe obesity 3.2 % with female of 44 %, male 26.4 %
-The prevalence of overweight and obesity was higher amongst a group of married women than among a group of single women in Saudi Arabia.

Regarding Obesity: Female >Male, Regarding the Overweight: Male> Female

Mechanism of obesity:

Food intake and utilization is regulated:

Hormones | Neurotransmitters | CNS

-Signals from peripheries are carried out by neurotransmitters and hormones to CNS in presence or absence of food.

-Signal from fat by hormone leptin to hypothalamus to reduce food intake and increase sympathetic activity and energy expenditure.

-Gastric distension and contraction send signal for satiety and hunger

-Fall in blood sugar send signals to CNS for hunger.

-Sympathetic activity from food thermogenesis leads to reduce food intake.

Role of hypothalamus in mediation of hunger and satiety:

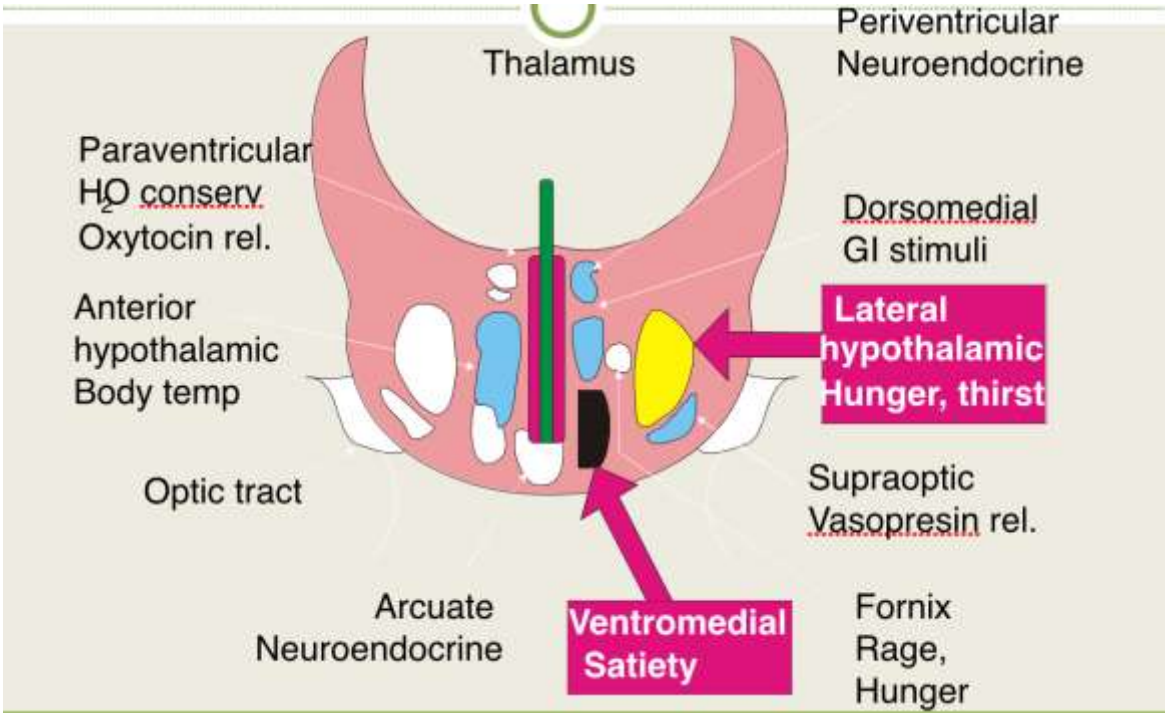


Table 1. Causes of Obesity

Excessive/inappropriate food intake
Sedentary lifestyle
Genetic disorders with obesity
Prader-Willi syndrome
Bardet-Biedl syndrome
Carpenter's syndrome (acrocephalopolysyndactyly type II)
Cohen syndrome
Endocrine disorders
Cushing's syndrome
Hypothalamic tumors/inflammation/trauma
Hypothyroidism
Polycystic ovary syndrome
Insulinoma
Drugs
Antipsychotics, especially atypical agents
Tricyclic antidepressants
Sulfonylureas
Insulin
β Blockers
Corticosteroids
Estrogen
Progestins

Obesity pathogenesis:

More in and less out = weight gain

More out and less in = weight loss

Hypothalamus: Control center for hunger and satiety

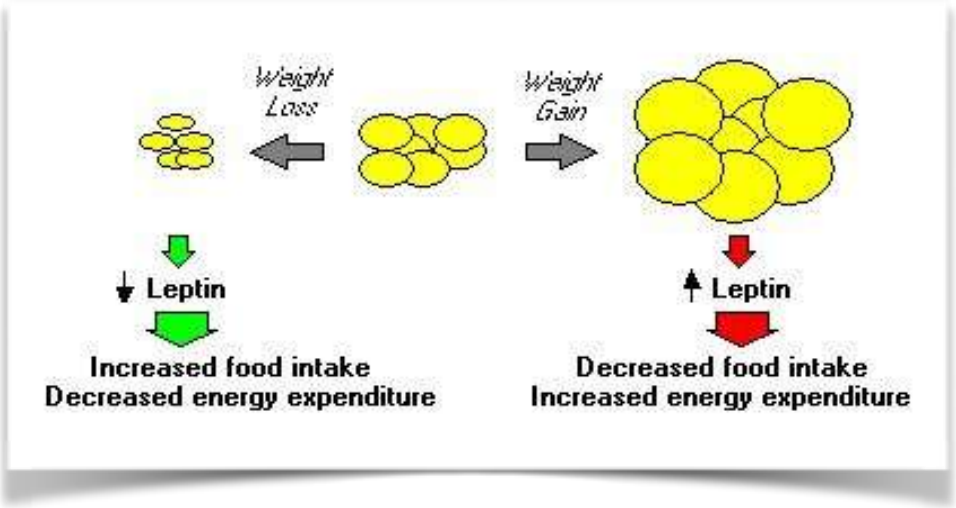
Endocrine disorders:

Hormones:

1-Leptin from adipocytes:

*It's a SATIETY HORMONE that Acts on hypothalamus to decrease food intake and stimulate energy expenditure.

Obese people have Leptin deficiency> so, there are no enough hormones



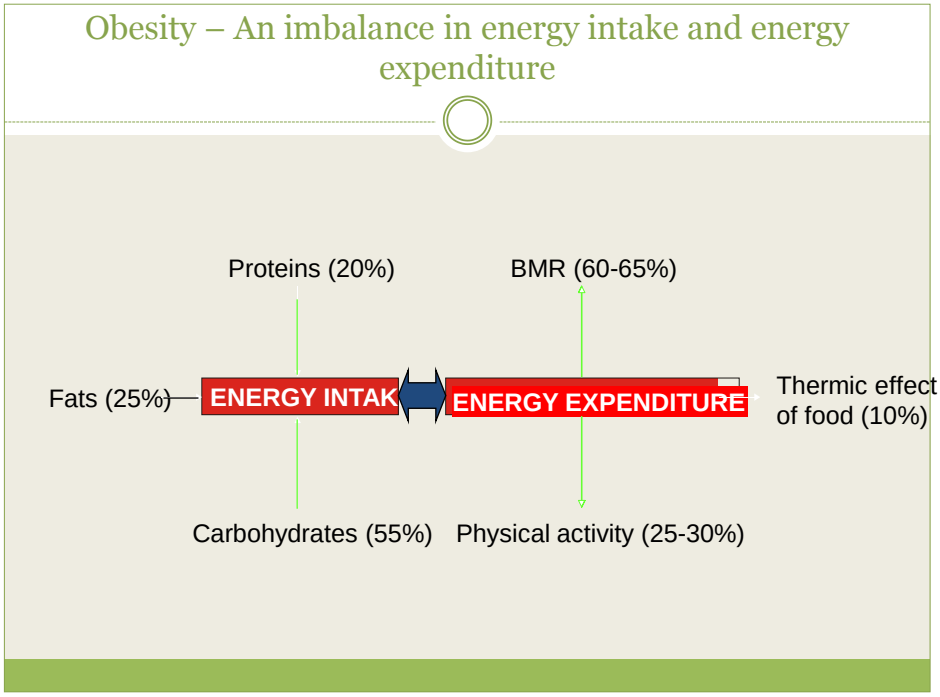
to send signals to the hypothalamus to inform that you are full and STOP EATING.

2- Ghrelin: Opposite of Leptin (gives signal to the hypothalamus that YOU HAVE TO EAT).

-Secreted in the stomach

-Acts on hypothalamus to stimulate appetite

-Peak before meal and decrease after



*the energy intake= what we eat

*the energy expenditure= the basal metabolic rate

Obesity: How does it happen??!

Calories consumed not equal calories used over a long period of time due to combination of several factors:

-Individual behaviors (10 % to BMI)
-Social interaction
-Environmental factors
-Genetic (40 % to BMI and adiposity)

Risk Factors:

Lifestyle:

-Sedentary lifestyle lowers energy expenditure

-52 % of Saudi women are inactive, < 19 % doing regular physical activity

-Prolonged TV watching

Sleep deprivation:

- < 7 hours of sleep ⟶ obesity

-↓ sleep ⟶ ↓ leptin, ↑ ↑ Ghrelin ⟶ ↑ appetite and CHO eating at night

Cessation of smoking:

-Because they were spending more time in smoking than eating and smoking decreases the appetite, while now after quoting smoking they will fill the free time with eating.

-Average weight gain is 4 kg

-Due to nicotine withdrawal

-Can be prevented by calories restriction and exercise program

Social influences:

-Obese parents most likely to have obese children

-Obese individuals are surrounded by obese friends

Diet:

-Overeating, frequency of eating, high fat meal, fast food (> 2 fast food/wk)

-Night eating syndrome: if > 25 % of intake in the evening.

Health consequences:

-Increase cost rate on obesity (Because of the complications)

-Increase number of sick leaves for obese subjects

-Increase number of hospitalization

-Early age of retirement

-Increase cost of drugs for DM, CVD, and GI disease

-Poor quality of life due to psychosocial issues

-Greater BMI is associated with increased death from all causes and from CVD.

-Although overweight associated with decreased survival

-Each 5 kg/m2 increase in BMI was associated with significant increase in mortality related to:

-IHD and stroke.

-Diabetes and non-neoplastic kidney disease.

-Different types of cancer.

-Respiratory disease.

-Obesity is associated with reduction in life expectancy during adulthood

-Increase in BMI is associated with increase in morbidity and CVD risk factors.

-One of the very common health consequences of obesity is the osteoarthritis. so, to relieve it you have to lose weight.

-Obese people tend to develop polycystic ovary syndrome, and people with polycystic ovary syndrome tend to be obese.so, it's a cyclic syndrome.

Table 2. Complications Associated with Obesity

Cardiovascular	Coronary artery disease, stroke, congestive heart failure, hypertension, dysrhythmias, pulmonary embolism
Pulmonary	Obstructive sleep apnea and obesity hypoventilation syndrome
Endocrine	Metabolic syndrome, insulin resistance, dyslipidemia, diabetes mellitus type 2, polycystic ovary syndrome
Gastrointestinal	Gallstones, abdominal hernia, nonalcoholic fatty liver disease, gastroesophageal reflux disease
Bone, joint, and skin	Osteoarthritis, low back pain, gout, acanthosis nigricans
Vascular	Venous stasis
Neurologic	Pseudotumor cerebri
Gynecologic/ genitourinary	Stress incontinence, sexual dysfunction, abnormal menses

NOTE: Obesity is also associated with cancer of the esophagus, colon, pancreas, liver, prostate, breast, endometrium, cervix, and ovaries.

Classic hyperpigmented axillary lesion in acanthosis nigricans.
Courtesy of Jeffrey Flier, MD.

For both men and women, increasing BMI was associated with higher death rates due to the following cancers:

-Esophagus

-Colon and rectum

-Liver

-Gallbladder

-Pancreas

-Kidney

-Non-Hodgkin lymphoma

-Multiple myeloma

Assessment and screening:

Screening of adults for obesity is important, with significant increase in morbidity and mortality, although not in routine practice but it should be as a part of periodic health assessment.

Screening:

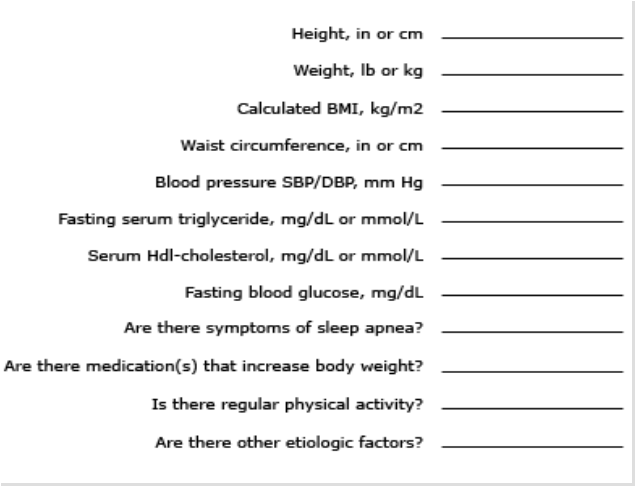
-BMI measurement

-Waist circumference (As there is increase in the waist circumference ——>>the risk of developing CVD will be increased)

-Evaluation of overall medical risks

-Is the patient obese or overweight?

-What are his key health issues? Morbidity and mortality-related.



Height, in or cm	
Weight, lb or kg	
Calculated BMI, kg/m2	
Waist circumference, in or cm	
Blood pressure SBP/DBP, mm Hg	
Fasting serum triglyceride, mg/dL or mmol/L	
Serum Hdl-cholesterol, mg/dL or mmol/L	
Fasting blood glucose, mg/dL	
Are there symptoms of sleep apnea?	
Are there medication(s) that increase body weight?	
Is there regular physical activity?	
Are there other etiologic factors?	

BMI measurement:

-Reliable, easy, correlated with percentage of body fat

-Guide for selection of therapy

-Varies among different races

-Recent WHO classification applied to whites, hispanics and black

-Asians are different: overweight BMI 23-24.9 kg/m2 and obesity by BMI > 25 kg/m2

Waist circumference:

-Measurement of central adiposity

-Associated with increased risk of morbidity and mortality

-Reflects visceral adiposity

-Increase risk of heart disease, DM, hypertension, dyslipidemia

-Important in identifying the risk in BMI 25-34.9 kg/m2

-Risk increase with WC > 88 cm in women, 102 cm in men

-Not useful if BMI > 35 kg/m2

-In Asian population risk starts with WC > 80 cm in Asian women and > 90 cm in Asian men.

Etiologic classification of obesity

Iatrogenic causes
Drugs that cause weight gain
Hypothalamic surgery
Dietary obesity
Infant feeding practices
Progressive hyperplastic obesity
Frequency of eating
High fat diets
Overeating
Neuroendocrine obesities
Hypothalamic obesity
Seasonal affective disorder
Cushing's syndrome
Polycystic ovary syndrome
Hypogonadism
Growth hormone deficiency
Pseudohypoparathyroidism
Social and behavioral factors
Socioeconomic status
Ethnicity
Psychological factors
Restrained eaters
Night eating syndrome
Binge-eating
Sedentary lifestyle
Enforced inactivity (post-operative)
Aging
Genetic (dysmorphic) obesities
Autosomal recessive traits
Autosomal dominant traits
X-linked traits
Chromosomal abnormalities
Other
Low birth weight

Identify the aetiology:

-Medical history is important

-Age at onset of obesity, course of it

-Eating habits, activity habits

-Past medical history

-Medications

-Cessation of smoking history

-Ethnic background

-Family history of obesity

Note: You don't need to know about medications. Read it for your knowledge.

Mainly Antipsychotic drugs

Drugs that cause weight gain and alternatives

Category	Drugs that cause weight gain	Possible alternatives
Antipsychotics		
Conventional	Thioridazine	Haloperidol
Atypical	Olanzapine, Clozapine, Quetiapine, Risperidone	Ziprasodone, Aripiprazole
Lithium	Lithium carbonate	
Anti-depressants		
Tricyclics	Amitriptyline, Clomipramine, Doxepin, Imipramine, Nortriptyline	Protriptyline
Selective serotonin reuptake inhibitors	Paroxetine	Other SSRIs
Other	Mirtazapine	Bupropion, Nefazadone
Anticonvulsant drugs	Valproate, Carbamazepine, Gabapentin	Topiramate, Lamotrigine, Zonisamide
Antidiabetic drugs	Insulin, Sulfonylureas, Metiglinide, Thiazolidinediones	Metformin, Alpha-glucosidase inhibitors
Serotonin and histamine antagonist	Pizotifen	
Antihistamines	Cyproheptidine	
Beta-adrenergic blockers	Propranolol, Atenolol, Metoprolol	
Steroid hormones	Glucocorticoids	
	Progestins: Megestrol acetate, Medroxyprogesterone acetate	

Assessment of risk status:

Identify risk factors:

-After BMI and WC, history

-BP measurement

-Fasting lipid profile

-Fasting blood sugar

Identify comorbidity:

-Help to classify the risk of mortality

-Presence of atherosclerosis, DM2, HTN, dyslipidemia

-Sleep apnoea

-GI, osteoarthritis, gout

CVD risk factors that would affect mortality risk:

-HTN

-DM2 (fasting blood glucose 110-125 mg/dl)

-Smoking

-Dyslipidemia (low HDL < 35 or high LDL> 130)

-Family history of premature CAD

-Physical inactivity

Other risk factors:

-Age of onset of obesity

Why is it important to look at it?

-It is a common disease with significant morbidity and mortality and without screening many high risk patients may not receive counseling about health risks, lifestyle changes, obesity treatment options, and risk factor reduction.

-Screening with BMI, waist circumference, and risk factor assessment is inexpensive and available to nearly all clinician.

-Weight loss is associated with a reduction in obesity-associated morbidity.

Advantages of weight loss:

-Survival increased 3-4 months for every kilogram of weight loss

-Reduced hyperlipidemia, hypertension and insulin resistance

-Improvement in severity of diseases

-Person feels ‘fit’ and mentally more active

Treatment Goals:

-Prevention of further weight gain.

-Weight loss to achieve a realistic, target BMI.

-Long-term maintenance of a lower body-weight.

Q) How much weight loss is significant?

A 5-10% reduction in weight (within 6 months) and weight maintenance should be stressed in any weight loss program and contributes significantly to decreased morbidity.

Management:

3 main interventions:

-Lifestyle intervention (diet, exercise).

-Pharmacotherapy.

-Surgical intervention.

Lifestyle:

-Diet

-Physical activity

-Behavior change

Initial goal: 10% weight loss

-Significantly decreases risk factors

Rate of weight loss:

-1-2 pound per week

-Reduction of calories intake 500-1000 calories/day

Slow weight loss is preferred approach

-Rapid weight loss is almost always followed by rapid weight gain

-Rapid weight loss is associated with gallstones and electrolytes abnormalities.

Aim for 4-6 months for weight loss

Average is 8-10 kg loss

After 6 months, weight loss is difficult

-Ghrelin and leptin effect

-Energy requirement decreased as weight decreases

Set goals for weight maintenance for next 6 months then reassess

Diet Therapy:

-Indicated for all with BMI > 30 and those with BMI 25- 30 with co-morbidities.

-Teaching about food composition (fat, CHO, protein).

-Calories contents of food by reading labels.

-Type of food to buy and to prepare.

-Low calories diet-portion controlled

-Low fat diet

-Low CHO diet

-Meditarraean diet

-Average for women: 1000-1200 kcal/day

-Average for men: 1200-1600 kcal/day
-Adjust based on activity and weight
-Then weight maintenance

-How much should people eat?

How much is 1200 calories?

- 1 big mac (580)
- 1 small fries (210)
- 1 small shake (430)

Male	**Age 20-49**	**2900 kcal/day**
	Age 50 +	***2500 Kcal/day***
Female	***Age 20-49***	***2300 Kcal/day***
	Age 50+	***1900 Kcal/day***

Physical Activity:

As integral part of weight loss

Reduce risk of DM, heart disease, hypertension

Alone is not helping

Help to prevent weight regain

Start slowly:

-Change of daily living activities

-Avoid injury

Increase intensity and duration gradually

Long –term goal:

-30-45 min or more of physical activity daily

-5 or more days per week

-Burn 1000+ calories per week

Keep agenda of diet and activity

-Set specific goals regarding: diet, activity related behavior

-Reminder system

-Reward yourself

-Don't deprive yourself, watch portion

Track improvement:

-Weight measurement on regular basis

Pharmacotherapy:

Indicated in:

-BMI > 30

-BMI 27-30 with comorbidities

-Should not be used for cosmetic weight loss

-Used only when 6 months trial if weight and exercise fail to achieve weight loss.

Sympathomimetics:

-Stimulate release of norepinephrine or inhibits its reuptake by nerve terminals

-Block serotonin and NE reuptake (sibutramine)

-Directly act upon adrenergic receptor

-Reduced appetite by early satiety

Pancreatic lipase inhibitor:

Orlistat: inhibits fat absorption

Antidepressant

Antiepileptic

Diabetic drugs: metformin.

Don't concentrate on the pharmacotherapy

Drugs approved by the FDA for treatment of obesity

Drug	Trade names	Dosage	DEA schedule
Pancreatic Lipase inhibitor approved for long-term use			
Orlistat	Xenical	120 mg three times daily before meals	-
Norepinephrine-serotonin reuptake inhibitor approved for long-term use			
Sibutramine	Meridia	5 to 15 mg/day	IV
	Reductil		
Noradrenergic drugs approved for short-term use			
Diethylpropion	Tenuate	25 mg three times daily	IV
	Tenuate Dospan	75 mg every morning	
Phentermine	Adipex	15 to 37.5 mg/day	IV
	Ionamin Slow Release	15 to 30 mg/day	
Benzphetamine	Didrex	25 to 50 mg three times daily	III
Phendimetrazine	Bontril	17.5 to 70 mg three times daily	III
	Prelu-2	105 mg daily	

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Recommendation for use of drugs listed in the American College of Physicians guidelines

Drug	Net weight loss (kg) (statisticians view)	Gross weight loss (kg) (patients view)	Recommendation
Orlistat	-2.75	-8.25	Approved for long term use
Sibutramine	-4.45	-9.95	Approved for use up to two years
Phentermine	-3.6	-9.1	Approved for short term use (12 weeks)
Diethylpropion	-3.0	-8.5	Approved for short term use (12 weeks)
Fluoxetine	-14.5 to + 0.4	-21 to -5.6	Not recommended
Bupropion	-2.77	-8.27	Not recommended

Net weight loss assumes an average weight loss of 5.5 kg with placebo. The 5.5 kg is then subtracted from the gross weight loss achieved with drug therapy.

With permission from: George Bray, MD. Data adapted from Li Z, Maglione M, Tu W, et al. Ann Intern Med 2005; 142:532. Snow, V, Barry, P, Fitterman, N, et al. Ann Intern Med 2005; 142:525.

Surgical therapy: Important

Indicated in:

-Well-informed and motivated patients.

-Have BMI > 40.

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-Acceptable risk of surgery.

-Failed previous non-surgical method.

-BMI > 35 with comorbidities like diabetes, sleep apneoa, osteoarthritis, cardiomyopathy.

-BMI 25-29.9 with WC > 102 cm in male and 88 cm in women.

-Age 18-60. (Not less than 18 y/o because they considered children)

-Psychologically stable.

Restrictive-type of surgery:

Vertical banded-gastroplasy

Gastric banding

Malabsorptive and restrictive:

Roux-en-Y gastric bypass

Biliopancreatic diversion

Follow up is crucial.

Summary

1.Obesity is considered to be a global epidemic, particularly in developed nations.
2.Health hazards associated with obesity: hypertension, heart disease, hyperlipidemia, type2 diabetes, stroke, heart disease, osteoarthritis, liver disease, Cancer, obstructive sleep apnea, and depression.
3.How to diagnose Obesity?
a. Body Mass Index (BMI) = weight/height^2 (KG/m^2)
- BMI of 18.5 to 24.9 is normal
- BMI of 25 to 29.9 is overweight
- BMI of 30 and over is obese
- BMI of 40 and over is considered morbidly obese

b. Waist circumference (WC) and waist hip ratio (WHR):
- Important in identifying the risk in BMI 25-34.9 kg/m2
- WC: Risk increase with WC > 88 cm in women, 102 cm in men
- WHR: risk increases with WHR > 0.8 in women and > 1 in men

c. Identify etiology (history), risk factors (BP measurement, Fasting lipid profile, Fasting blood sugar) and comorbidities (Presence of atherosclerosis, DM2, HTN, dyslipidemia, Sleep apnoea, GI diseases, osteoarthritis, gout).

4.Classification of obesity as per fat distribution:
a. Android (or abdominal or central, males)
- Collection of fat mostly in the abdomen (above the waist)
- apple-shaped
- Associated with insulin resistance and heart disease

b. Gynoid (below the waist, females)
- Collection of fat on hips and buttocks
- pear-shaped
- Associated with mechanical problems

5.Treatment:
a. Diet, exercise, lifestyle modification are mainstays of treatment
b. Drug therapy: for patients who have not succeeded in losing weight with diet and exercise. Orlistat is a first line agent and can be continued for up to 4 years.
c. Bariatric surgery
- Effective in reducing co morbidities associated with obesity including hypertension, diabetes, obstructive sleep apnea and hyperlipidemia. This translates to 29% reduction in mortality. Only indicated in patients who have earnestly tried other means of losing weight and have been unsuccessful.
- Best evidence is for patients with BMI over 40.
- Bariatric surgery is based on 2 mechanisms:
  - Restriction of intake (via a small stomach reservoir) which is technically easier, have lower complication rates, but result in less weight loss than malabsorptive techniques.
  - Malabsorption (via decreasing small bowel length).

Questions

1. A 40 year old woman, 155 cm tall and weighing 85.5 Kg. Her waist hip ratio measured 1.05. A physical examination and blood laboratory data were all within the normal range. Her only child, who is 14 years old, her sister, and both of her parents are overweight. The patient recalls being obese throughout her childhood and adolescence. Over the past 15 years she had been on seven different diets for periods of 2 weeks to 3 months, losing from 5–25 pounds. On discontinuation of each diet, she regained weight, returning to 185–190 pounds. Which one of the following best describes this patient?

A. She is classified as overweight.
B. She shows an "apple" pattern of fat distribution.
C. She would be expected to show lower than normal levels of circulating triacylglycerols.
D. She would be expected to show lower than normal levels of circulating leptin.

2. Surgery for obesity should be considered in all except:

A. patients with BMI >30 with comorbidities
B. Have BMI > 40.
C. BMI 25-29.9 with WC > 102 cm in male and 88 cm in women.
D. BMI > 35 with comorbidities like diabetes, sleep apneoa, osteoarthritis, cardiomyopathy.

Answers:

1- B

A is incorrect because BMI=85.5/1.55^2 = 35.6 and that indicates that she's obese not overweight.
B is correct because she has high waist to hip ratio and that indicates apple pattern.
C is incorrect because obese people have high triacylglycerols.
D is incorrect because leptin secreted from adipocytes is high in obese people because it Acts on hypothalamus to decrease food intake and stimulate energy expenditure when there is weight gain.

2- A