Obesity

presented by
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Disclosures

- I have no Disclosures

Objectives

- Define Obesity
- Contributors to Obesity
- Complications of Obesity
- Lifestyle /Behavioral Modification
- Diet types, caloric intake
- Expenditure /Exercise
- Obesity inducing Environmental Factors
- Hormones of Satiety Impacting obesity
- Medications: Pharmacology and Affordability

Definition per WHO

- Overweight is a condition of excessive fat deposits
- Obesity is a chronic complex disease defined by excessive fat deposits that can impair health by leading to multiple medical comorbidities

Diagnosis of Overweight/Obesity

- Adults
- BMI greater than 25 overweight
- BMI greater than 30 Obesity

- Children under 5
- 2 standard deviations above WHO child growth standard = Overweight
- 3 standard deviations above = Obesity

Diagnosis

- Children 5-19
- Bmi for age 1 standard deviation above WHO median = Overweight
- Bmi for age 2 standard deviations above WHO Median = Obesity

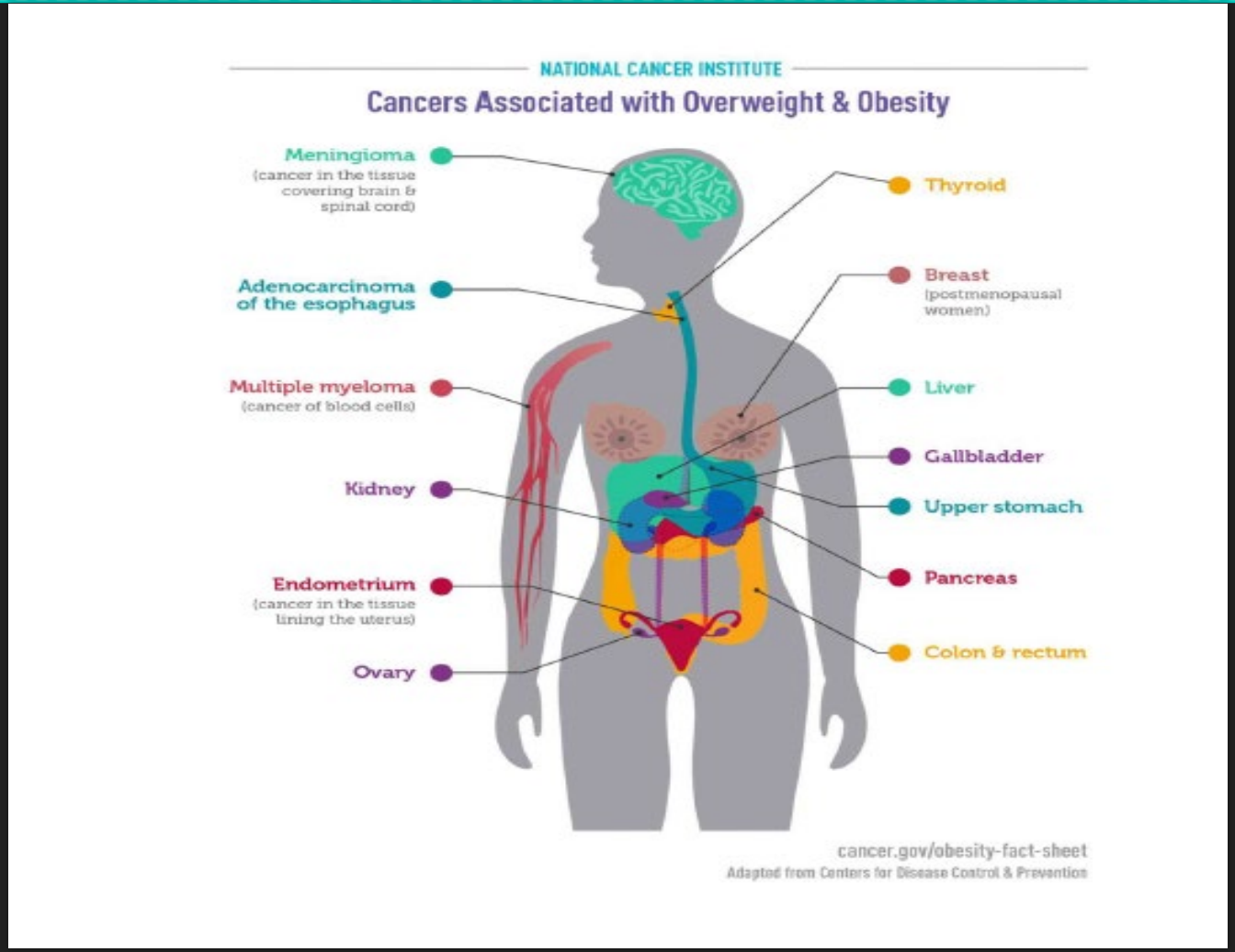
Obesity Comorbidities

- Type 2 Diabetes, heart disease, stroke, bone health decline, impaired reproduction, as well as increases risk of certain cancers
- Obesity influences sleep quality and ambulation, causing sleep apnea overtime and degenerative arthritis of spine and lower extremities over time
- Mental Distress and Stigma
- Linked to NAFLD and CKD. Central obesity is linked to increased microalbuminuria ,and obesity's impact on blood pressure, cholesterol, and sugar control indirectly contribute to kidney disease .
- Contributor to Asthma
- Contributor to Gallbladder Disease

Obesity Linked Cancers

- Breast cancer
- Colon and Rectal Cancer
- Esophageal and Stomach Cancer
- Gallbladder and Pancreatic Cancer
- Liver and Kidney Cancer
- Ovarian Cancer
- Thyroid
- Multiple Myeloma
- Meningioma

Overview of Cancers Related to Obesity



Obesity Statistics in 2022 Worldwide

- 1 in 8 people in world living with obesity
- Worldwide has doubled since 1990 and adolescent obesity has quadrupled
- 43% overweight with 16% of these obese
- 2.5 billion adults overweight and 890 million obese
- 37 million children under age 5 are overweight
- Ages 5-19 390 million overwt and 160 million obese

US Obesity Statistics

- Greatest health care related Crisis in US
- Greater than 40% of adults and 19% of children Oct 2023
- Obesity is more prevalent among adults with lower education levels and lower incomes
- Processed food, sedentary lifestyle, Fast food industry
- Black 49.9% Hispanics 45.6% White 41.1% Asian 16.1%

Obesity Categories

- Class I : 30-34.9 BMI
- Class 2 : 35-39.9 BMI
- Class 3 : 40 or above

Other means of diagnosis

- BMI does not differentiate between body fat and lean mass
- Obesity can also be defined as body fat percentage, waist circumference or waist to hip ratio

Criteria of Overweight and Obesity

Table 3.2. Criteria of Overweight and Obesity

	Normal	Overweight	Obesity
BMI	18.5 to 24.9 kg/m^2	25 to 29.9 kg/m^2	≥30 kg/m^2 Class I: 30 to 34.9 kg/m^2 Class II: 35 to 39.9 kg/m^2 Class III: ≥40 kg/m^2
BMI in Asian adult	<23 kg/m^2	≥23 kg/m^2	
Percent body fat	Men: <25% Women: <32%		Men: ≥25% Women: ≥32%
Waist circumference	Men: <40 in (102 cm) Women: <35 in (88 cm)		Men: ≥40 in (102 cm) Women: ≥35 in (88 cm)
Waist circumference in Asian adult	Men: <35.4 in (90 cm) Women: <31.4 in (80 cm)		Men: ≥35.4 in (90 cm) Women: ≥31.4 in (80 cm)
Waist-to-hip ratio			Men: >0.9 Women: >0.85
EOSS		Stage 0,1,2,3,4	Stage 0,1,2,3,4

BMI = body mass index; EOSS = Edmonton Obesity Staging System.

Edmonton Obesity Staging System

Stage 0:	Absent = Normal blood glucose (no clinical risk factor)
Stage 1:	Mild = Impaired fasting glucose (preclinical risk factor)
Stage 2:	Moderate = Type 2 diabetes (established disease)
Stage 3:	Severe = Microvascular/macrovascular disease
Stage 4:	End-stage = Blindness, end-stage renal disease

Calorie expenditure

- BMR 70% when lose wt reduces BMR , impacts efforts to sustain energy deficit
- Thermogenic Effects of Food: 10% calorie expenditure. Number of calories burned to digest, absorb, and store nutrients. Protein has a higher thermic effect than fat or carbs.
- Exercise and nonexercised thermogenesis :20 % of calorie expenditure.

Non-exercise Activity Thermogenesis

- Outside of sleep , eating, and structured exercise
- Fidgeting, standing, climbing stairs, walking dog, pacing, cleaning house, working in a factory.

Physical activity intensity

- Light physical activity (3 mets) short bouts of activity = walking slowly, sitting at desk, standing to cook, washing dishes, playing musical instrument, fishing
- Moderate (3-6 mets) walking moderate pace less than 4mph, vacuum, mopping, mowing lawn , cycling 10-12mph, playing tennis or badminton, swimming, dancing, gardening
- High (greater than 6mets) fasting walking 14-16mph, jogging 6mph, shoveling, swimming, Zumba or vigorous aerobic dance, playing basketball, soccer, or singles tennis

Weight loss by Exercise Type

Table 4.4. Expected Weight Loss by Exercise Type

Exercise Type	Expected Weight Loss
Aerobic exercise only	0-2 kg
Resistance training only	No weight loss
Aerobic exercise and resistance training	0-2 kg
Calorie restriction and aerobic exercise	9-13 kg
Aerobic Physical Activity per Week	**Expected Weight Loss**
<150 minutes	No or minimal weight loss
150-224 minutes	2-3 kg
225-420 minutes	5-7.5 kg
200-300 minutes	Weight maintenance after weight loss

Exercise and Calorie Restriction most Successful

Activity Recommendations

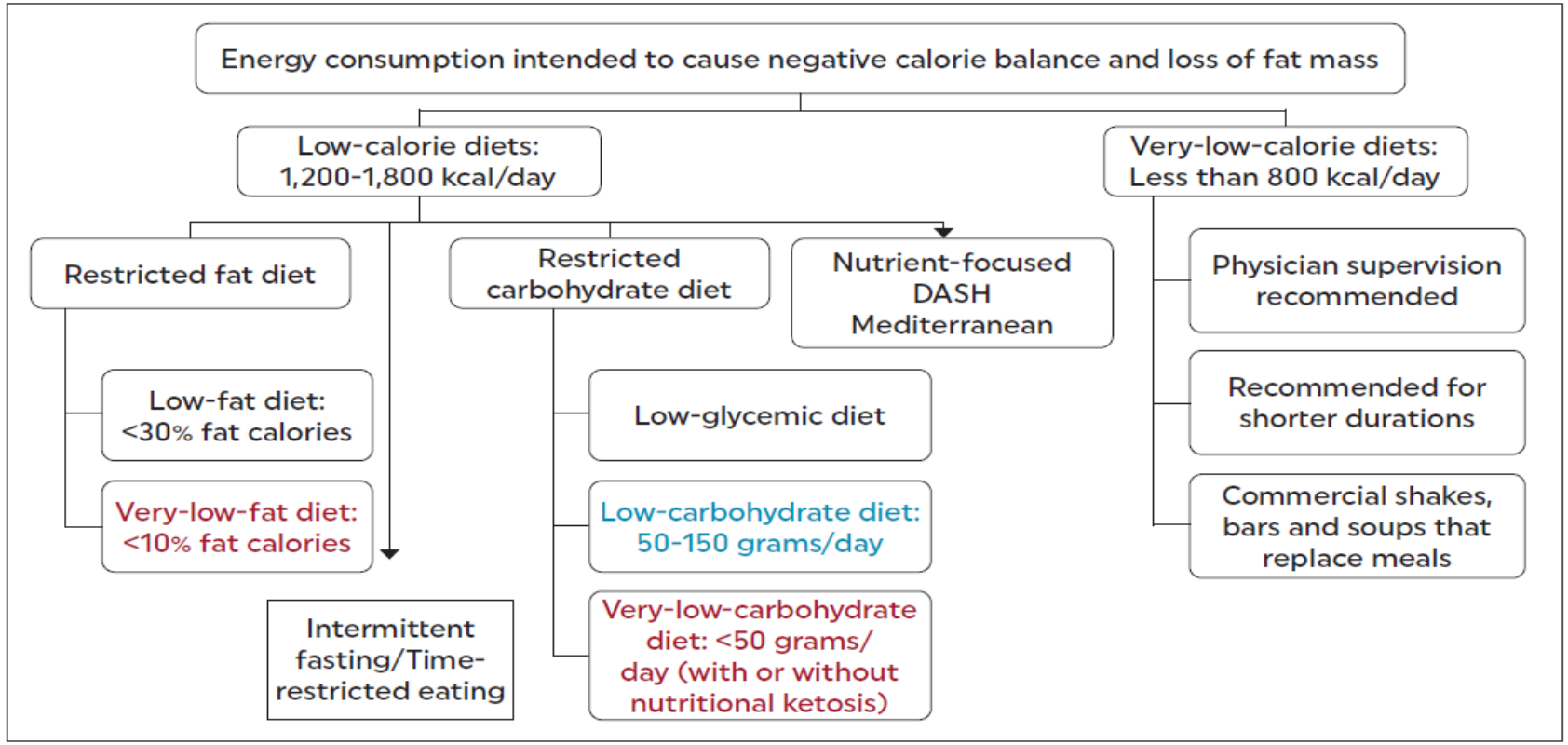
TABLE 3

Recommendations for Adult Physical Activity

Moderate-intensity aerobic activity should total at least 150 minutes per week *or* vigorous-intensity aerobic activity should total at least 75 minutes per week (additional health benefits can be seen with moderate-intensity aerobic activity of 300 minutes or more per week)

Caloric intake

Figure 4.2. Nutritional Therapy



DASH = Dietary Approaches to Stop Hypertension.

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Low Fat vs Low Carb Diets

- Data indicate that there is no significant difference in weight loss with low fat or low carb diets with calorie control at 12 months, but low-fat diet have sustained weight loss longer.

Meal plan for Adolescents

Food Group Amounts for 1,800 Calories a Day for Ages 14+ Years

Fruits	Vegetables	Grains	Protein	Dairy
1½ cups	**2½ cups**	**6 ounces**	**5 ounces**	**3 cups**
Focus on whole fruits Focus on whole fruits that are fresh, frozen, canned, or dried.	**Vary your veggies** Choose a variety of colorful fresh, frozen, and canned vegetables—make sure to include dark green, red, and orange choices.	**Make half your grains whole grains** Find whole-grain foods by reading the Nutrition Facts label and ingredients list.	**Vary your protein routine** Mix up your protein foods to include seafood; beans, peas, and lentils; unsalted nuts and seeds; soy products; eggs; and lean meats and poultry.	**Move to low-fat or fat-free dairy milk or yogurt (or lactose-free dairy or fortified soy versions)** Look for ways to include dairy or fortified soy alternatives at meals and snacks throughout the day.

Limit

Choose foods and beverages with less added sugars, saturated fat, and sodium. Limit:

- Added sugars to **less than 45 grams** a day.
- Saturated fat to **less than 20 grams** a day.
- Sodium to **less than 2,300 milligrams** a day.

Activity

Be active your way:

Children 6 to 17 years old should move **60 minutes** every day. Adults should be physically active at least **2½ hours** per week.

Pharmacotherapy

- FDA approves Anti-obesity Medications for adults with BMI of 30 or with Bmi of 27 with a weight related comorbidity.
- People who do not achieve weight loss of 5 percent or more with lifestyle changes alone within 3-6 mo should be considered

Pharmacotherapy in Adolescents

- FDA has approved the following Weight Management Medications for ages 12 and older
- Orlistat (Xenical)
- Liraglutide (Saxenda)
- Phentermine-topiramate (Qsymia)
- Semaglutide (Wegovy)

Anti-obesity Medication Newcomers

- Imcivree or Setmelanotide : melanocortin 4 receptor agonist indicated for 6 and above who have Bardet-Biedi syn, POMC, PCSK1 or Leptin receptor def
- Plenity or Gelesis 100 / prescription Device for adults BMI 25-40 , superabsorbent hydrogel nonstimulant, nonsystemic wt loss aid. 27% had 10 percent wt loss and 59% had 5 percent wt loss

Short Term Anti-obesity Medications

Table 5.1. Antiobesity Medications Approved for Short-Term Use

Drug	Phentermine	Diethylpropion	Phendimetrazine	Benzphetamine
Classification	Schedule IV controlled substance	Schedule IV controlled substance	Schedule III controlled substance	Schedule III controlled substance
Dosage	Common dosage is 4 mg, 1 to 3 times daily. Extended-release forms are available in 15 mg, 30 mg and 37.5 mg tablets. Phentermine can be started with a low dose and then titrated up as needed for optimal effect on both appetite control and side effects.	Can be used as 1 immediate-release 25 mg tablet up to 3 times daily or as 1 sustained-release 75 mg tablet daily	Can be used as a 35 mg capsule up to 3 times daily or as a 105 mg sustained-release capsule daily	Can be used at 25 mg to 50 mg, 1 to 3 times daily
Indication	Indicated for short-term use (approximately 12 weeks)			
Mechanism of action	Typically causes release of norepinephrine, decreases norepinephrine reuptake and reduces appetite			
Contraindications	Sympathomimetics are contraindicated during or within 14 days following the administration of MAOIs. Other contraindications include pregnancy, nursing, glaucoma, agitated states, history of drug abuse, history of cardiovascular disease and hyperthyroidism.			
Precautions	Pulmonary hypertension, cardiac valvular disease, concomitant alcohol use, hypertension, renal impairment May impair the patient's ability to engage in potentially hazardous activity such as operating machinery or driving a motor vehicle When used with concomitant dietary restrictions, sympathomimetics may affect insulin and oral hypoglycemic medication requirements. Therefore, patients need to be aware of signs and symptoms of hypoglycemia.			
Potential adverse effects	Headache, dizziness, fatigue, hypoglycemia, back pain, cough, nausea, dry mouth, constipation			

MAOIs = monoamine oxidase inhibitors.

Long Term Meds for Weight Loss

Table 5.2. Antiobesity Medications Approved for Long-Term Use

Drug	Orlistat*	Phentermine/topiramate ER	Naltrexone/bupropion ER
Description	Gastric lipase inhibitor and pancreatic lipase inhibitor that reduces the absorption of calories and fat from ingested food.	Phentermine is a sympathomimetic that causes release of norepinephrine, decreases norepinephrine reuptake and reduces appetite. Topiramate increases GABA, a major inhibitory neurotransmitter in the brain, and decreases carbonic anhydrase IX. It usually causes taste aversion. Using ER forms and combining phentermine and topiramate can effectively manage the side effects of each of these drugs.	Naltrexone is an opioid antagonist that works in the pleasure center; therefore, it may be effective for people who have cravings or use food for pleasure. Bupropion decreases norepinephrine and dopamine reuptake and provides increased energy and appetite control.
Dosage	120 mg capsule 3 times daily with meals	- Can be started at 1 capsule phentermine 3.75 mg/topiramate 23 mg ER daily for 14 days, then increased to 7.5 mg/46 mg daily. - If ≥3% weight loss is not achieved after 12 weeks, the dose may be increased to 11.25 mg/69 mg daily for 14 days. - Maximum dose is 15 mg/92 mg daily.	- Week 1: 1 tablet naltrexone 8 mg/ bupropion 90 mg tablet daily in the morning - Week 2: 1 tablet BID - Week 3: 2 tablets in the morning, 1 tablet in the evening - Week 4 and beyond: 2 tablets BID
Average weight loss	5% of BW	A 56-week RCT found that completers on 3.75 mg/23 mg lost 6.7% of BW and completers on 15 mg/92 mg lost 14.4% of BW.	Clinical trial data showed participants lost 5% to 15% of BW.
Indication	Adults: BMI ≥30 kg/m² or BMI ≥27 kg/m² with at least one weight-related comorbid condition (e.g., diabetes, hypertension, dyslipidemia)		
Contraindications	Pregnancy, chronic malabsorption syndrome, cholestasis	- Pregnancy, glaucoma, hyperthyroidism - Contraindicated during or within 14 days following the administration of MAOIs	- Pregnancy, uncontrolled hypertension, seizure disorder or history of seizures, anorexia nervosa or bulimia - Contraindicated in patients on chronic opioid therapy because naltrexone will block the effect of opiates - Contraindicated in patients who are undergoing abrupt discontinuation of alcohol, benzodiazepines, barbiturates and antiepileptic medications - Contraindicated during or within 14 days following the administration of MAOIs

Medication that Decreases Norepinephrine and Decreases Appetite

- Stimulants
- Phentermine and Wellbutrin

Medications that Cause Taste Aversion

- TOPAMAX

Medication Causing Fat Malabsorption by inhibiting effects of Lipase

- ORLISTAT

GLP-1 Delays Gastric Emptying and causes Central Satiety (Hypothalamus)

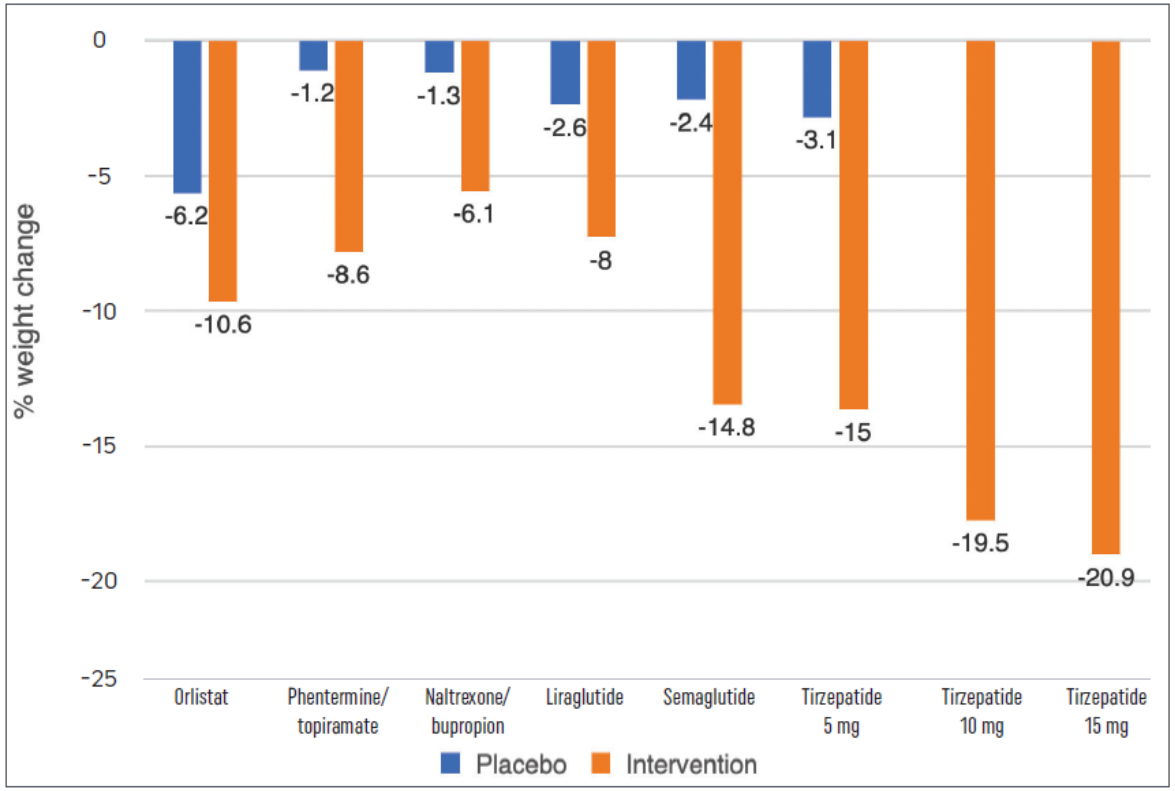
Table 5.3. GLP-1 and GIP/GLP-1 Receptor Agonists Approved for Long-Term Obesity Treatment

Drug	Liraglutide	Semaglutide	Tirzepatide
Dosage	Daily SQ injection increased every 7 days. Available in doses of 0.6 mg, 1.2 mg, 1.8 mg, 2.4 mg and 3 mg.	Weekly SQ injection increased every 4 weeks. Available in doses of 0.25 mg, 0.5 mg, 1 mg, 1.7 mg and 2.4 mg.	Weekly SQ injection increased every 4 weeks. Available in doses of 2.5 mg, 5 mg, 7.5 mg, 10 mg, 12.5 mg and 15 mg.
Average weight loss	9.2% of BW compared with 3.5% in placebo group	14.9% of BW compared with 2.4% in placebo group	20.9% of BW compared with 3.1% in placebo group
Indication	Adults: BMI ≥30 kg/m^2 or BMI ≥27 kg/m^2 with at least one weight-related comorbid condition (e.g., diabetes, hypertension, dyslipidemia)		
Mechanism of action	Affects central satiety and delays gastric emptying		
Contraindications	Pregnancy, personal or family history of medullary thyroid cancer, multiple endocrine neoplasia type 2		
Precautions	Serious hypoglycemia when used with insulin or other secretagogues, acute pancreatitis, acute gallbladder disease, heart rate increase, renal impairment associated with dehydration Monitor for depression and suicidal behavior and ideation		
Potential adverse effects	Nausea, vomiting, dyspepsia, diarrhea, constipation, GERD, headache, dizziness, fatigue, hypoglycemia, abdominal pain, increased lipase		

BMI = body mass index; BW = body weight; GERD = gastroesophageal reflux disease; GIP = glucose-dependent insulinotropic polypeptide; GLP-1 = glucagon-like peptide-1; SQ = subcutaneous.

What medications most successful

Figure 5.1. Mean Percent Weight Change With Antiobesity Medications



Adapted with permission from Chakhtoura M, Haber R, Ghezzawi M, et al. Pharmacotherapy of obesity: an update on the available medications and drugs under investigation. *EclinicalMedicine.* 2023;58:101882.

Satiety Hormones on the Hypothalamus

- Leptin makes you feel full (fat cells signal are full) GLP increases Leptin
- Ghrelin makes you feel hungry (stomach signal empty)

GLP1 Rebound

A study of semaglutide (Wegovy) found that participants regained two-thirds of their original weight lost 1 year after discontinuation of therapy, highlighting the need for long-term management.

Weight inducing medications

Table 5.5. Effects of Medications on Body Weight

Clinical Condition	Weight-Promoting Medications	Weight-Neutral Medications	Weight-Friendly Medications
Diabetes	Insulin Meglitinides Sulfonylureas Thiazolidinediones	DPP-4 inhibitors Metformin	Acarbose GLP-1 RA injectable and oral (exenatide, liraglutide, semaglutide, tirzepatide) Pramlintide SGLT2 inhibitors
Blood pressure	Beta blockers	ACE inhibitors Carvedilol CCBs	Chlorthalidone HCTZ
Migraine	Atenolol Propranolol	Cardizem Verapamil	Topiramate
Depression	Most SSRIs Some TCAs Some MAOIs Lithium Mirtazapine Mood stabilizers	Venlafaxine	Bupropion
BED ADHD/ADD			Lisdexamfetamine Methylphenidate
Seizure	Carbamazepine Gabapentin Valproate	Lamotrigine Levetiracetam Phenytoin	Topiramate Zonisamide

ACE = angiotensin-converting enzyme; ADD = attention-deficit disorder; ADHD = attention-deficit/hyperactivity disorder; BED = binge eating disorder; CCB = calcium channel blocker; DPP-4 = dipeptidyl peptidase-4; GLP-1 RA = glucagon-like peptide-1 receptor agonists; HCTZ = hydrochlorothiazide; MAOIs = monoamine oxidase inhibitors; SGLT2 = sodium-glucose cotransporter 2; SSRIs = selective serotonin reuptake inhibitors; TCAs = tricyclic antidepressants.

Weight Inducing Medications

TABLE 2

Common Medications That Contribute to Weight Gain or Loss

Medication class	Weight promoting	Weight neutral/variable	Weight reducing
Antidepressants	Tricyclic antidepressants, paroxetine	Citalopram, venlafaxine, desvenlafaxine (Pristiq), duloxetine (Cymbalta), escitalopram, fluoxetine, sertraline	Bupropion
Antihistamines	Diphenhydramine, cetirizine, fexofenadine	—	—
Antipsychotics/ mood stabilizers	Chlorpromazine, clozapine, olanzapine (Zyprexa), quetiapine, risperidone, brexpiprazole (Rexulti), lithium, thioridazine	Aripiprazole, haloperidol, ziprasidone, paliperidone (Invega)	—
Cardiovascular agents	Atenolol, metoprolol, propranolol, calcium channel blockers	Angiotensin-converting enzyme inhibitors, carvedilol (Coreg), dihydropyridine calcium channel blockers	—
Chemotherapies and anti-inflammatory agents	Tamoxifen, cyclophosphamide, methotrexate, aromatase inhibitors, corticosteroids	Nonsteroidal anti-inflammatory drugs	—
Diabetic agents	Insulin, meglitinides, sulfonylureas, thiazolidinediones	Dipeptidyl pepitidase-4 inhibitors	Alpha-glucosidase inhibitors, glucagon-like peptide-1 receptor agonists, metformin, pramlintide (Symlin), sodium-glucose cotransporter-2 inhibitors
Hormones	Estrogens, intramuscular progestins, corticosteroids	Intrauterine or oral progestin, combined oral contraceptives	Testosterone
Hypnotics	Zolpidem*	Medications in the benzodiazepine class, trazodone	—
Seizure medications	Carbamazepine, gabapentin, pregabalin (Lyrica), valproate	Lamotrigine, levetiracetam, phenytoin, oxcarbazepine	Felbamate, topiramate, zonisamide

Which meds more favorable for Weight Loss

- Anti-depressants: Effexor, Wellbutrin, Prozac
- Mood Stabilizers: Abilify, Latuda, Lamictal
- Cardiovascular : Coreg, Norvasc (non-dihydropyridine), ARB/ACE, Diuretics
- Diabetes : SGLT2,DDP4, GLP, metformin (acarbose GI side effects)
- Sleep : Trazodone
- Seizure : Zonisamide, Topamax,

Candidates for Bariatric Surgery

- BMI greater than 40
- BMI greater than 35 with at least one weight-related comorbidity
- Body weight that is 100lb above ideal body weight

Bariatric Surgery Threshold Criteria

TABLE 5

Threshold BMI Levels for Consideration of Bariatric Surgery

American Society for Metabolic and Bariatric Surgery* and International Federation for Surgery of Obesity and Metabolic Disorders (2022)	American Association of Clinical Endocrinology/American College of Endocrinology, The Obesity Society, American Society for Metabolic and Bariatric Surgery,* Obesity Medicine Association, American Society of Anesthesiologists (2019)	American College of Cardiology/ American Heart Association/The Obesity Society (2013)
BMI ≥ 35 kg per m^2	BMI ≥ 40 kg per m^2	BMI ≥ 40 kg per m^2
BMI ≥ 30 kg per m^2 with type 2 diabetes mellitus	BMI ≥ 35 kg per m^2 with obesity-related comorbidity	BMI ≥ 35 kg per m^2 with obesity-related comorbidity
BMI ≥ 30 kg per m^2 without substantial or durable weight loss or comorbidity improvement using nonsurgical methods	BMI 30 to 34.9 kg per m^2 and type 2 diabetes with inadequate glycemic control despite optimal lifestyle and medical therapy	
Persons of Asian descent*:		
BMI ≥ 25 kg per m^2 with type 2 diabetes		
BMI ≥ 25 kg per m^2 without substantial or durable weight loss or comorbidity improvement using nonsurgical methods		
BMI ≥ 27.5 kg per m^2		

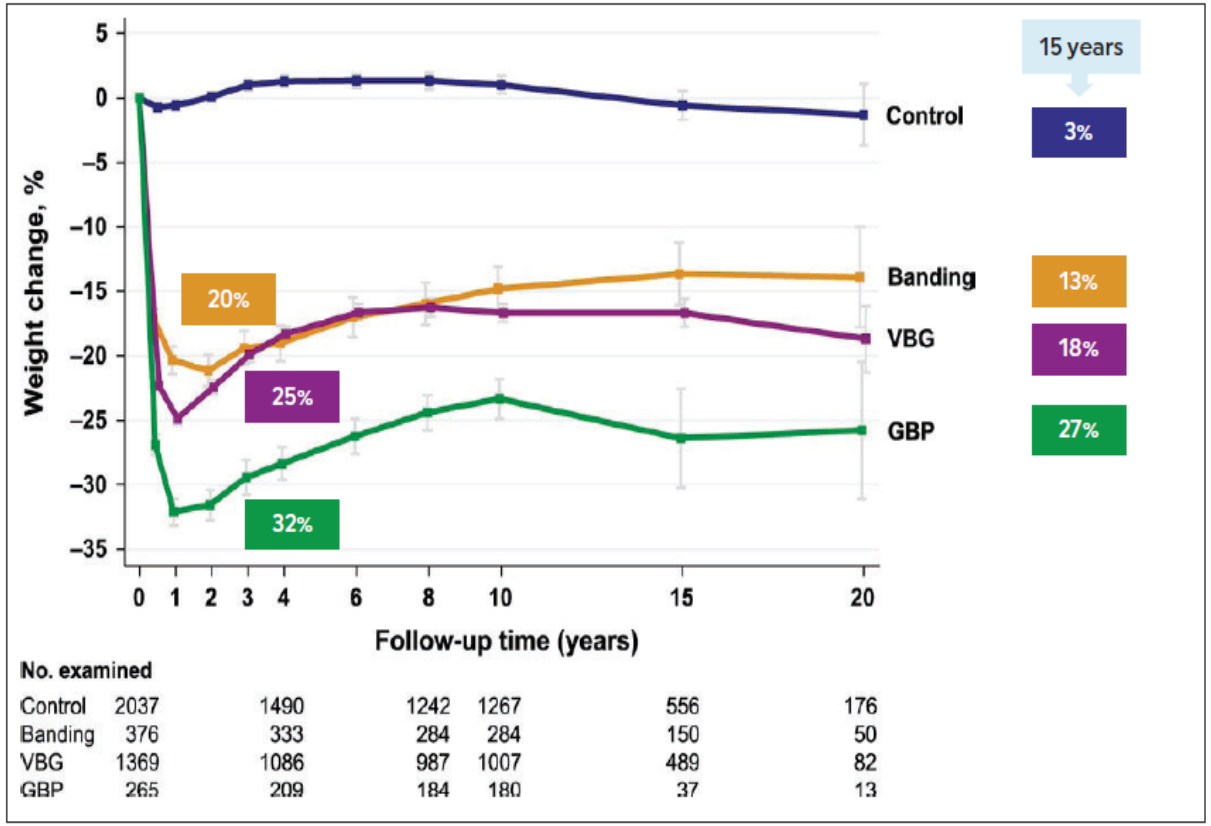
BMI = body mass index.

*—American Society for Metabolic and Bariatric Surgery guidelines do not differentiate among Asian ethnicities.

Information from references 9, 55, and 56.

Success Rate of Bariatric Modalities

Figure 5.2. Results From the Swedish Obese Subjects Trial



GBP = gastric bypass; VBG = vertical banded gastroplasty.

Adapted with permission from Sjöström L. Review of the key results from the Swedish Obese Subjects (SOS) trial – a prospective controlled intervention study of bariatric surgery. *J Intern Med.* 2013;273(3):219-234.

The 5 A's of Obesity Management

Component	Description	Clinical Example
Assess/Ask	Ask for permission to discuss weight	"Could we talk about your weight?" "Do you have any concerns about your weight today?"
	Explore readiness to make changes	"Is your weight something you're ready to take action on or have time to commit to right now?"
	Assess metabolic risk factors, waist-to-hip ratio, BMI, body composition, weight trends and obesity stage	– Review current, past and family medical history to identify metabolic risk factors associated with obesity – Review current medication list to identify weight-promoting medications – Review sleep patterns and psychosocial elements
Advise	– Advise about the health risks of obesity – Discuss the health benefits of 5%-10% weight loss – Review comprehensive treatment options	"Although a heavier weight is not always correlated with poor health, we can see here that your blood sugar is rising. That puts you at a high risk for developing type 2 diabetes, which can lead to heart disease and kidney disease. Research has consistently shown that even a 5% weight loss — which would be [X amount] of weight for you — can dramatically decrease your risk of developing type 2 diabetes. There are many treatment options that we can discuss if you'd like to. They include making dietary changes and adding more movement into your day, if that would be safe, as well as working on getting 7 hours of sleep or more per night. Medicine may even be an option."
Agree	Agree on what intervention the patient would like to start with and set realistic, attainable short- and long-term goals	"Since you're currently working 2 jobs that take up a lot of your time, do you think that you could walk for 5 minutes during your 20-minute breaks?" "Could you set an alarm on your phone that reminds you to start getting ready for bed 30 minutes earlier than you usually go to bed?"
Assist	- Assist in identifying and addressing barriers that make weight management challenging - Provide resources - Assist in finding and consulting with appropriate health care professionals	"I know gym memberships are expensive, but here is a list of community gyms and programs that are based on a sliding scale fee schedule."
Arrange	Set follow-up appointment within 1-3 months to review progress	"Let's follow up in 6 weeks to see how you are doing on this. I know it can be hard to stick to a program, so I want you to know that I'm here for you to support and cheer you on."

BMI = body mass index.

Five A's

- Ask Permission to Discuss Weight
- Advise about Health Risks
- Agree on Intervention
- Assist in Identifying Barriers
- Arrange for Close Followup

Motivational Interviewing

- Engage- work a partner or coach to barriers to care
- Focus- clear objectives
- Evoke- Identify their motivator for change, reinforce past successes
- Plan- SMART goals

Thermogenic Foods that increase Metabolism

- Coffee
- Turmeric
- Ginger
- Cinnamon
- High protein yogurt
- Coconut oil
- Black pepper
- Hot peppers
- Mushrooms
- Turkey , chicken, lean red meat
- Green Tea
- Mustard

FDA approval for GLP Agents

- Wegovy FDA approved for Cardiovascular Disease
- Zepbound FDA approved for OSA
- Semaglutide Studied in NAFLD but not FDA approved for