Objectives

- Know the prevalence of overweight and obesity across the lifecycle
- Know the definitions of overweight and obesity utilizing the NHLBI guidelines for adults and the AAP Expert Panel for children
- Discuss the multifactorial etiology of obesity
- Understand the neurohormonal mechanisms that regulate body weight
- Apply the principles of evaluation of patients with obesity
- Describe the different medication and surgical options for obesity management

Lecture Road Map

- Quick Review
  - Definitions
  - Prevalence
- Pathophysiology of Obesity
- Evaluation and Management
For the MHD Exam

- Physiology of weight regulation
- Role of activity/exercise in weight regulation
- Role of Lifestyle interventions
- Indications for medication and surgical intervention
- Weight loss medications
- Evidence-based dietary recommendations

RC is a 41 year-old male who visits the doctor for an annual wellness visit. He has no health concerns. His Body Mass Index (BMI) is 31.2 kg/m²

Audience Response System

What does BMI represent?
A) An estimate of total body protein mass
B) An estimate of total body fat mass
C) An estimate of total body water mass
D) An estimate of total body carbohydrate mass
Defining Obesity

- Body Mass Index
  - Weight (kg)/height (m²)
  - Weight (lb)/height (in²) x 703
  - Table
  - Limitations
- Waist Circumference
  - High risk:
    - Men >102 cm (40 in.)
    - Women >88 cm (35 in.)

National Heart, Lung, and Blood Institute (NHLBI)
Classification of Overweight and Obesity by BMI

<table>
<thead>
<tr>
<th>Classification</th>
<th>BMI Category</th>
<th>Risk of developing health problems</th>
</tr>
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<tbody>
<tr>
<td>Underweight</td>
<td>&lt;18.5</td>
<td>Increased</td>
</tr>
<tr>
<td>Normal weight</td>
<td>18.5–24.9</td>
<td>Least</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.0–29.9</td>
<td>Increased</td>
</tr>
<tr>
<td>Obese</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class I</td>
<td>30–34.9</td>
<td>High</td>
</tr>
<tr>
<td>Class II</td>
<td>35–39.9</td>
<td>Very high</td>
</tr>
<tr>
<td>Class III</td>
<td>&gt;40</td>
<td>Extremely high</td>
</tr>
</tbody>
</table>

American Academy of Pediatrics
Expert Panel on Obesity

<table>
<thead>
<tr>
<th>Weight Status Category</th>
<th>Percentile Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>Less than the 5th percentile</td>
</tr>
<tr>
<td>Healthy weight</td>
<td>5th percentile to less than the 85th percentile</td>
</tr>
<tr>
<td>Overweight</td>
<td>85th to less than the 95th percentile</td>
</tr>
<tr>
<td>Obese</td>
<td>Equal to or greater than the 95th percentile</td>
</tr>
</tbody>
</table>

Severe Obesity = 99th percentile
Severe Obesity vs. “Morbid” Obesity
Prevalence of Obesity

- Data Comes From the Centers For Disease Control
  - Behavioral Risk Factor Surveillance System (BRFSS)

Pediatric Obesity

Being Overweight or Obese affects 1/3rd of all children and adolescents from all racial and socioeconomic backgrounds.
**Childhood Obesity**

- Mostly established prior to age 5
- In 2016, Increase in childhood obesity has plateaued, but severe obesity is still rising

**Causes of Obesity**

**Intrinsic**
- Genetics
- Calorie Intake
- Sleep
- Activity
- Endocrine Disorders
- Metabolic Programming
- Microbiome

**Extrinsic (Environmental)**
- Toxins
  - Medications
  - BPA
  - PF0A (C8)
  - Artificially Sweetened Beverages
- Viruses
- Medications
- Types of Calories

**Weight Homeostasis (Lipostat)**

- Energy Intake
- Energy Expenditure
Lipostat

- Energy Intake
  - Types of Calories
  - Hunger
    - Psychological
    - Social
    - Genetic
    - Sleep?

- Energy Expenditure
  - Activity
  - Metabolism
    - Genetics
    - Toxins
    - Endocrine Hormones
    - Metabolic Programming
    - Sleep?

Appetite Control

- Leptin
  - Stimulates
  - Hypothalamus
  - Decreases Appetite

- Adiponectin
  - Directs Fatty Acids to Muscle for degradation

- Ghrelin
  - Stimulates Appetite
  - "Meal initiating"

- Peptide YY
  - Satiety Signal

- Glucagon Like-Polypeptide-1
  - Stomach and Small Intestine
  - Decreases Appetite

Genetics and Obesity
Weight Homeostasis

- Calories in and calories burned (Energy Balance)
- Calorie = Calorie: NO!!
- Designed to store calories for future famine
- Ignore natural hunger mechanism
- Set point (AKA Lipostat) increases as body weight increases
- As you decrease calories, metabolic rate decreases too
- Go below the set point and you are hungry

Raw vs Processed Food

- Naked Chicken Chalupa
  - 440 calories
  - 270 from fat

- 1/2 Cup Raw Almonds
  - 413 calories
  - 319 from fat
ARS
Which of the following is associated with obesity:
A) Marijuana use
B) Sleep deprivation
C) Chicago Bears fandom
D) Being single
E) Moderate alcohol intake

Metabolic Programming
• Environmental and nutritional influences at critical periods of development
• Maternal Body Weight
  – Risk of obesity if born pre/post maternal gastric bypass
  – Maternal consumption of artificially sweetened beverages increases risk of obesity in offspring
  – Not Breast Feeding
• Infancy and Childhood
  – Higher protein diet = increased risk of developing obesity any time in life (Cows Milk/Breastmilk)

Recommended Weight gain in Pregnancy

<table>
<thead>
<tr>
<th>BMI</th>
<th>Recommended Weight Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;18.5 (underweight)</td>
<td>28-40 pounds</td>
</tr>
<tr>
<td>18.5-24.9 (normal weight)</td>
<td>25-35 pounds</td>
</tr>
<tr>
<td>25-29.9 (overweight)</td>
<td>15-25 pounds</td>
</tr>
<tr>
<td>&gt;30 (obese)</td>
<td>11-20 pounds</td>
</tr>
</tbody>
</table>
Maternal Weight Gain

- Excessive weight gain
  - 24% of normal weight women
  - 62% of overweight women
  - 56% of obese women

- No additional calories in trimester 1
- 350-450 extra calories a day in trimesters 2 and 3 (3 glasses of orange juice or a single donut)

Other Contributing Factors

- Sleep <7 hours/night
- Microbiome (early exposure to antibiotics)
- Toxins (BPA- estrogen modulator, PFOA - Teflon)
- Viruses – Adenovirus
- Pollution exposure
- Cessation of smoking
- Iatrogenic – Meds- Prednisone, Valproate, Gabapentin
- Night eating syndrome (25% of calories between dinner and breakfast)
- Lack of breakfast

Cultural -Societal

- Culture of Quick
- Live Far From Work
- High Stress
- Decreased Physical Activity
- Increased portion sizes
- Processed foods
- Liquid Candy
Group Discussion

RC is a 41-year old male who visits the doctor for an annual wellness visit. He has no health concerns. His Body Mass Index (BMI) is 31.2 kg/m²

Mr. C is now in front of you in your clinic. How would you assess his health?

History

- Chest Pain
- Shortness of Breath
- Abdominal Pain
- Joint Aches
- Snoring, sleep apnea symptoms
- Depression/Anxiety symptoms
- Medications/Substance Use
- Diet History
- Activity History
- Stress and Coping Exploration
- Social Situation
- Prior Experience with weight loss attempts

Clinical Findings

From Tsai et al. "Obesity" in Annals of Internal Medicine 2013
http://annals.org/aim/article/1733796/obesity
Acanthosis Nigricans

Testing

- Readiness for Change Inventory
- Depression Screen
- Epworth Sleepiness Scale
- TSH, Fasting Lipid Profile, HgB A1C, Fasting Glucose, Creatinine
- Consider
  - Sleep study
  - Cardiac Stress Test
  - Pulmonary Function Test
  - Psychological Evaluation

Group Discussion

RC 41 y/o male
BMI is 31.2 kg/m²
BP 132/88
TSH, glucose, creatinine, lipid profile are all within normal limits.
Sleep study shows severe sleep apnea

Mr. C is now in front of you in your clinic. What would you recommend to improve his health?
2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults

Endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation, American Pharmacists Association, American Society for Nutrition, American Society for Parenteral and Enteral Nutrition, American Society for Preventive Cardiology, American Society of Hypertension, Association of Black Cardiologists, National Lipid Association, Preventive Cardiovascular Nurses Association, The Endocrine Society, and WomenHeart: The National Coalition for Women with Heart Disease

© American College of Cardiology Foundation and American Heart Association, Inc.

Obesity Guidelines

- Backed by stringent methodology
- Therefore, speak with authority
- But limited in scope:
  - Who needs to lose weight?
  - What are the benefits of weight loss and how much weight loss is needed?
  - What is the best diet?
  - What is the efficacy of lifestyle intervention?
  - What are the benefits and risks of the bariatric surgical procedures?

Treatment Algorithm

The Chronic Care Model of Weight Management by PCPs
Recommendation 1

1a. Measure height and weight and calculate BMI at annual visits or more frequently.

1b. Use the current cutpoints for overweight (BMI 25.0-29.9 kg/m²) and obesity (BMI ≥ 30 kg/m²) to identify adults who may be at elevated risk of CVD and the current cutpoints for obesity (BMI ≥ 30 kg/m²) to identify adults who may be at elevated risk of mortality from all causes.

1c. Advise overweight and obese adults that the greater the BMI, the greater the risk of CVD, type 2 diabetes, and all-cause mortality.

1d. Measure waist circumference at annual visits or more frequently in overweight and obese adults. Advise adults that the greater the waist circumference, the greater the risk of CVD, type 2 diabetes, and all-cause mortality. The cutpoints currently in common use (from either NIH/NHLBI or WHO/IDF) may continue to be used to identify patients who may be at increased risk until further evidence becomes available.

Recommendation 2

1. Overweight and obese adults with cardiovascular risk factors (high BP, hyperlipidemia, and hyperglycemia), that lifestyle changes that produce even modest, sustained weight loss of 3%-5% produce clinically meaningful health benefits, and greater weight losses produce greater benefits.

a. Sustained weight loss of 3%-5% is likely to result in clinically meaningful reductions in triglycerides, blood glucose, hemoglobin A1c, and the risk of developing type 2 diabetes.

b. Greater amounts of weight loss will reduce BP, improve LDL-C and HDL-C, and reduce the need for medications to control BP, blood glucose and lipids as well as further reduce triglycerides and blood glucose.
Recommendation 3a
Prescribe a diet to achieve reduced calorie intake for obese or overweight individuals who would benefit from weight loss, as part of a comprehensive lifestyle intervention. Any one of the following methods can be used to reduce food and calorie intake:

a. Prescribe 1,200–1,500 kcal/d for women and 1,500–1,800 kcal/d for men (kilocalorie levels are usually adjusted for the individual’s body weight);

b. Prescribe a 500-kcal/d or 750-kcal/d energy deficit; or
c. Prescribe one of the evidence-based diets that restricts certain food types (such as high-carbohydrate foods, low-fiber foods, or high-fat foods) in order to create an energy deficit by reduced food intake.

Recommendation 3b
Prescribe a calorie-restricted diet for obese and overweight individuals who would benefit from weight loss, based on the patient’s preferences and health status, and preferably refer to a nutrition professional* for counseling. A variety of dietary approaches can produce weight loss in overweight and obese adults, as presented in CQ3, ES2.

*Nutrition professional: In the studies that form the evidence base for this recommendation, a registered dietitian usually delivered the dietary guidance; in most cases, the intervention was delivered in university nutrition departments or in hospital medical care settings where access to nutrition professionals was available.

Recommendation 4

4a. Advise overweight and obese individuals who would benefit from weight loss to participate for ≥6 months in a comprehensive lifestyle program that assists participants in adhering to a lower-calorie diet and in increasing physical activity through the use of behavioral strategies.

4b. Prescribe on-site, high-intensity (i.e., ≥14 sessions in 6 months) comprehensive weight loss interventions provided in individual or group sessions by a trained interventionist.†

4c. Electronically delivered weight loss programs (including by telephone) that include personalized feedback from a trained interventionist can be prescribed for weight loss but may result in smaller weight loss than face-to-face interventions.

†Trained interventionist: In the studies reviewed, trained interventionists included mostly health professionals (e.g., registered dietitians, psychologists, exercise specialists, health counselors, or professionals in training) who adhered to formal protocols in weight management. In a few cases, lay persons were used as trained interventionists; they received instruction in weight management protocols (designed by health professionals) in programs that have been validated in high-quality trials published in peer-reviewed journals.
Recommendation 4 (con’t)

4d. Some commercial-based programs that provide a comprehensive lifestyle intervention can be prescribed as an option for weight loss, provided there is peer-reviewed published evidence of their safety and efficacy.

4e.‡ Use a very-low-calorie diet (defined as <800 kcal/d) only in limited circumstances and only when provided by trained practitioners in a medical care setting where medical monitoring and high-intensity lifestyle intervention can be provided. Medical supervision is required because of the rapid rate of weight loss and potential for health complications.

4f. Advise overweight and obese individuals who have lost weight to participate long term (≥1 year) in a comprehensive weight loss maintenance program.

‡There is strong evidence that if a provider is going to use a very-low-calorie diet, it should be done with high levels of monitoring by experienced personnel. That does not mean that practitioners should prescribe very-low-calorie diets. Because of concern that an ACC/AHA Class I recommendation would be interpreted to mean that patients should go on a very-low-calorie diet, it was the consensus of the Expert Panel that this maps more closely to an ACC/AHA Class IIa recommendation.

Recommendation 4 (con’t)

4g. For weight loss maintenance, prescribe face-to-face or telephone-delivered weight loss maintenance programs that provide regular contact (monthly or more frequently) with a trained interventionist† who helps participants engage in high levels of physical activity (i.e., 200–300 min/wk), monitor body weight regularly (i.e., weekly or more frequently), and consume a reduced-calorie diet (needed to maintain lower body weight).

†Trained interventionist: In the studies reviewed, trained interventionists included mostly health professionals (e.g., registered dietitians, psychologists, exercise specialists, health counselors, or professionals in training who adhered to formal protocols in weight management. In a few cases, lay persons were used as trained interventionists; they received instruction in weight management protocols (designed by health professionals) in programs that have been validated in high-quality trials published in peer-reviewed journals.

Recommendation 5

5a. § Advise adults with a BMI ≥40 kg/m² or BMI ≥35 kg/m² with obesity-related comorbid conditions who are motivated to lose weight and who have not responded to behavioral treatment with or without pharmacotherapy with sufficient weight loss to achieve targeted health outcome goals that bariatric surgery may be an appropriate option to improve health and offer referral to an experienced bariatric surgeon for consultation and evaluation.

§There is strong evidence that the benefits of surgery outweigh the risks for some patients. These patients can be offered a referral to discuss surgery as an option. This does not mean that all patients who meet the criteria should have surgery. This decision-making process is quite complex and is best performed by experts. The ACC/AHA criteria for a Class I recommendation states that the treatment/procedure should be performed/administered. This recommendation as stated does not meet the criteria that the treatment should be performed. Thus, the ACC/AHA classification criteria do not directly map to the NHLBI grade assigned by the Expert Panel.
Recommendation 5 (con’t)

5b. For individuals with a BMI <35 kg/m², there is insufficient evidence to recommend for or against undergoing bariatric surgical procedures.

5c. Advise patients that choice of a specific bariatric surgical procedure may be affected by patient factors, including age, severity of obesity/BMI, obesity-related comorbid conditions, other operative risk factors, risk of short- and long-term complications, behavioral and psychosocial factors, and patient tolerance for risk, as well as provider factors (surgeon and facility).

A Guide to Selecting Treatment

<table>
<thead>
<tr>
<th>Body Mass Index category</th>
<th>Diet, physical activity, and behavior therapy</th>
<th>Pharmacotherapy</th>
<th>Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-26.9</td>
<td>27-29.9</td>
<td>30-34.9</td>
<td>35-39.9</td>
</tr>
<tr>
<td>With co-morbidity</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>With co-morbidity</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>With co-morbidity</td>
<td>+</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lifestyle Modifications (BMI≥25)

From Tsai et al. "Obesity" in Annals of Internal Medicine 2013
http://annals.org/aim/article/1733796/obesity
Behavioral Therapy

- Weekly Treatment for first 6 months
- Goal Setting
- Activity and Dietary Changes
- Self-Monitoring
- Stimulus Control
- Long-Term Contact

VLCD = Very low Calorie Diet
BMOD = Behavioral Modification

HEALTHY EATING PLATE

Use healthy oils (like olive and canola oil) for cooking or salad dressing. Avoid trans fats. Avoid sugars.

Eat a variety of fruits, vegetables, whole grain bread, and beans.

Eat plenty of fruits of all colors.

Choose fish, poultry, beans, and nuts. Limit red meat and cheese.

Drink water, tea, or coffee (with little or no sugar). Limit sugary drinks.

Low-sodium (120 milligrams/day) and sugar-free whole-grain rice and whole-grain breads.

Lentils, beans, and whole-grain pasta, and brown rice. Limit refined grains (like white rice and white bread).

www.health.harvard.edu/
Diets

<table>
<thead>
<tr>
<th>Diet Type</th>
<th>Weight Loss At A Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ornish</td>
<td>14.4 x 1.6</td>
</tr>
<tr>
<td>Jenny Craig</td>
<td>14.5</td>
</tr>
<tr>
<td>Rosemary (Rawley)</td>
<td>14.1</td>
</tr>
<tr>
<td>Makmus</td>
<td>14.1</td>
</tr>
<tr>
<td>Volumetrics</td>
<td>13.2</td>
</tr>
<tr>
<td>Zone</td>
<td>13.1</td>
</tr>
<tr>
<td>Weight Watchers</td>
<td>13.0</td>
</tr>
</tbody>
</table>

Comparison of Weight Loss Among Named Diet Programs in Overweight and Obese Adults - A Meta-analysis

Exercise and Obesity

- For most healthy adults, the Department of Health and Human Services recommends these exercise guidelines:
  - **Aerobic activity.** Get at least 150 minutes of moderate aerobic activity or 75 minutes of vigorous aerobic activity a week, or a combination of moderate and vigorous activity. The guidelines suggest that you spread out this exercise during the course of a week.
  - **Strength training.** Do strength training exercises for all major muscle groups at least twice a week. Aim to do a single set of each exercise, using a weight or resistance level heavy enough to tire your muscles after about 12 to 15 repetitions.
- Activity is important (essentially 30 minutes a day)
- Exercise is not great for weight loss
- Exercise is great to maintain weight loss

Medications

(BMI 27-29.9 w/ Comorbidity or BMI ≥ 30)

From Tsai et al. "Obesity" in Annals of Internal Medicine 2013
http://annals.org/aim/article/1733379/obesity
Requirements for Surgery

- BMI 35-39.9 with OSA, CHD, T2DM, Refractory HTN
- BMI 40 or higher
- Active participation in physician-supervised comprehensive weight loss program (includes dietician, behavioral health provider, exercise) for minimum 6 months
Complications of Bariatric Surgery

- With 30 days
  - Death (1-3/1000)
  - Bowel Obstruction
  - Deep Venous Thrombosis
  - GI/Abdominal Bleeding
  - Leaks
  - Pulmonary Embolus
  - Wound Infection

- Long-Term
  - Anastomotic Stricture
  - Bowel Obstruction
  - Cholelithiasis
  - Dehiscence/Fistulization
  - GI/Abdominal Bleeding
  - Incisional Hernia
  - Marginal Ulceration
  - Nutritional Deficiencies

Benefits of Weight Loss Surgery the Swedish Obese Subjects Trial

Bariatric Surgery vs. Usual Care

- Nonrandomized prospective controlled study
- 2010 pts. had surgery compared to 2037 contemporaneously matched controls
- Began 1987
- Median follow up 14.7 years

Adapted from Daniel Bessesen, M.D.
The Endocrine Society (this slide and next two slides)
Weight loss in the SOS

Bariatric Surgery is Associated with a Reduced Mortality: the SOS Study

Your Future as a Doctor

• RC – A starting point
  – History of diet, stress, activity
  – Physical Exam and labs for complications
  – Diet diary
  – Use motivational interviewing and set goals
  – Reduce calories 500/day (1 pound per week)
  – Increase activity
  – Utilize dietician, behavioral health professional
Helping your overweight or obese child

- Tips, strategies and guidance for parents of overweight children
  - https://www.niddk.nih.gov/health-information/weight-management/helping-your-child-who-is-overweight
- Weight control tips tailored to teens

Thanks!

- Questions?