Key messages on obesity care from the 2023 ASPEN Physician Preconference Course: A narrative review

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Abstract
Obesity is a challenging chronic disease process that continues to affect a large percentage of the population at large. With the advent of new therapeutic options and interventions and a deeper scientific understanding of obesity as a complex illness, there is hope in curtailing this evolving pandemic. In this article, we present key medical information to engage and empower nutrition-focused providers to manage obesity and its nutrition complications. The topics summarized here were presented during the 2023 American Society for Parenteral and Enteral Nutrition Preconference Physician Course and include pathophysiology and hormonal regulation of obesity, multidisciplinary care planning and nutrition risk stratification of patients, and common approaches to treatment, including lifestyle modifications, antiobesity medications, and procedures from the perspective of the nutrition specialist.

KEYWORDS
anti-obesity medications, bariatric surgery, malnutrition, obesity, sarcopenic obesity

THE PROBLEM
Obesity is a global pandemic with multiple biological, structural, and social determinants. Although multiple definitions exist, the current definition is based on a body mass index (BMI) >25 or 30 (or >23 or 25 for patients identifying as having Asian heritage), indicating overweight or obesity, respectively. In the United States, obesity prevalence rates vary by geography and ethnocultural classification. These variations in prevalence result from complex interrelationships of social determinants of health (SDOH) and genetic predisposition.

OBESITY IS A COMPLEX DISEASE
Pathophysiology and impact
A fundamental pathophysiological derangement in obesity is the development of chronic inflammation in adipose tissue. Although the mechanism is still not fully elicited, inflammatory changes may be the result of chronic fat accumulation leading to cellular rupture in the setting of an enlarging adipose mass. In addition to generalized inflammation, obesity is a risk factor for most noncommunicable diseases as well as for frailty and disability.
The double burden of malnutrition

Historically, malnutrition represented inadequacy of energy and/or nutrient intake, resulting in a low BMI; however, a “double burden” of malnutrition that incorporates both undernutrition and obesity has more recently been identified. A combination of calorically dense, poor-quality foods in combination with a sedentary lifestyle have increased prevalence. In addition to poor lifestyle habits and genetic predisposition, increased rates of chronic disease in patients with obesity further enhances nutrition risk and loss of lean muscle mass, resulting in sarcopenic obesity.

SDOH

The conditions in which we live, learn, work, and play define our SDOH. These determinants translate into behaviors that implicate health. Substantial literature supports the attributable risk of disease associated with SDOH influencers, including educational status, social position, income, occupation, and ethnicity. Public policy and environmental factors that govern external forces on disease are additionally important and enhance disparities. They also influence patient engagement and effective treatment plans for obesity and associated chronic diseases.

Hormonal regulation

Several hormones are implicated in regulation of appetite and satiety, including leptin, ghrelin, peptide YY, neuropeptide Y, and insulin. The latter is directly affected by intestinally secreted hormones glucagon-like peptide-1 (GLP-1) and glucose-dependent insulinotropic polypeptide (GIP), which govern palatability, motivation for food, and appetite in response to ingested nutrients. These hormones additionally stabilize blood glucose, regulate adipose deposition, and retard gut motility, enhancing satiety in the postprandial state.

Sleep and obstructive sleep apnea

Adults are recommended to have 7–9 h of sleep each night to maintain optimal health. Decreased sleep and poor-quality sleep, as seen in obstructive sleep apnea, have complex and interrelated impacts on weight gain. Hormonal imbalances from decreased sleep induce appetite stimulation and increase food cravings, making adherence to nutrition intervention challenging. Furthermore, individuals with decreased sleep have less energy for exercise.

Environmental factors

Exposure to the modern “obesogenic” environment where highly energy-density, nutritionally poor foods are readily available in the form of ultraprocessed snacks and fructose-sweetened beverages increases obesity risk. Reduction in physical activity is also associated with excess weight gain. External factors that regulate nutrition choices and/or exercise opportunities include associated neighborhood socioeconomic status, crime rates, and accessible outdoor spaces and food stores.

OBESITY MANAGEMENT PRINCIPLES: THERAPEUTICS

Although the underlying principles of weight loss include induction of a moderate net energy deficit through changes in nutrition and physical activity, achieving this goal is challenging. To have durable success, a nutrition-focused provider should personalize recommendations to individual need, health history, environment and SDOH. A combination of lifestyle and nutrition modifications with medically supervised interventions may be necessary to optimize health outcomes. Appropriate nutrition risk stratification and monitoring are important across treatment approaches.

Multidisciplinary teams

The involvement of a multidisciplinary team is important for successful management of obesity, a chronic disease with high risk of relapse. An effective team includes an obesity-focused physician, a dietitian with weight loss–intervention expertise, and a psychologist who can screen for and address underlying disordered eating patterns and enhance patient engagement, outcomes, and appropriate monitoring.

Targeted lifestyle and behavioral modifications

Lifestyle modification lays the foundation of metabolic optimization because it establishes physical and mental commitment to enacting change. Patients following a lifestyle-based weight loss program are more likely to lose 5% of their total body weight (TBW) than patients without a plan are. These modalities are best applied in the context of behavioral change. Additionally, weight loss is associated with alterations in neurohormonal pathways that favor weight regain via enhancement of appetite and adaptive thermogenesis, further highlighting importance of targeted behavioral modification.

Nutrition interventions

Many nutrition interventions associated with purposeful weight loss have been studied and successfully implemented. These focus on inducing energy deficit via alterations in macronutrient composition and/or nutrition patterns. In practice, differences between specific nutrition approaches are small. For cardiometabolic risk mitigation, nutrition patterns that emphasize a high intake of plant-based foods and limit red and processed meats, such as the Mediterranean diet, are well validated.
<table>
<thead>
<tr>
<th>Name and mechanism of action</th>
<th>Dosing guidelines</th>
<th>Weight loss, % TBW (dose; time)</th>
<th>Nonresponder rate, % (dose)</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tirzepatide39 incretin: GIP and GLP-1 agonist</td>
<td>Start at 2.5 mg weekly; increase by 2.5 mg every 4 weeks to a maximum of 15 mg weekly</td>
<td>15% (5 mg; 72 weeks); 19.5% (10 mg; 72 weeks); 20.9% (15 mg; 72 weeks)</td>
<td>15% (5 mg); 11% (10 mg); 9% (15 mg)</td>
<td>History of medullary thyroid carcinoma, or MEN II syndrome, pregnancy; and caution in patients with renal impairment, volume depletion, gastroparesis, and pancreatitis</td>
</tr>
<tr>
<td>Semaglutide41,42 incretin; GLP-1 agonist</td>
<td>Start at 0.25 mg weekly; increase every 4 weeks to a maximum of 2.4 mg weekly</td>
<td>4.7% (0.5 mg; 52 weeks); 6.7% (1 mg; 52 weeks); 14.9% (2.4 mg; 68 weeks)</td>
<td>11% (2.4 mg)</td>
<td>History of medullary thyroid carcinoma or MEN II syndrome, pregnancy; and caution should be taken in patients with renal impairment, gastroparesis, pancreatitis, acute gallbladder disease, and suicidal history or ideations</td>
</tr>
<tr>
<td>Liraglutide43,44 incretin: GLP-1 agonist</td>
<td>Start at 0.6 mg daily; increase by 0.6 mg weekly to maximum of 3 mg daily</td>
<td>5%–7% (3 mg; 20 weeks)</td>
<td>60% (1.8 mg); 46% (3 mg)</td>
<td>History of medullary thyroid carcinoma or MEN II syndrome, pregnancy; and caution should be exercised in patients with renal impairment, pancreatitis, gallstones, suicidal history or ideations</td>
</tr>
<tr>
<td>Phentermine/topiramate45 sympathomimetic amine/multiplea</td>
<td>Start at 3.75/23 mg daily; increase by 3.75/23 every 14 days to a maximum of 15/92 mg</td>
<td>3.75/23 mg (5.1%; 56 weeks); 15/92 mg (10.6%; 56 weeks)</td>
<td>55% (3.75/23 mg); 48% (7.5/46 mg); 30% (15/92 mg)</td>
<td>Pregnancy, glaucoma, uncontrolled hyperthyroidism, and use of MAO inhibitors; caution should be utilized in patients with depression, suicidality, cognitive impairment, drug abuse, and tachycardia</td>
</tr>
<tr>
<td>Naltrexone/bupropion46 opioid receptor antagonist/norepinephrine and dopamine reuptake inhibitor</td>
<td>Start at 1 tablet of 8 mg/90 mg per day; increase weekly by adding 1 tablet to a maximum goal of 2 tablets twice daily</td>
<td>16/180 mg (5.0%; 56 weeks); 32/360 mg (6.1%; 56 weeks)</td>
<td>58% (32/360 mg)</td>
<td>Uncontrolled hypertension, seizure disorders, anorexia nervosa or bulimia, undergoing abrupt discontinuation of alcohol, benzodiazepines, barbiturates, and antiepileptic drugs, use of other bupropion-containing products, chronic opioid use, and MAO-inhibitor use within 14 days</td>
</tr>
<tr>
<td>Orlistat47 lipase inhibitor</td>
<td>120-mg capsule 3 times a day during or up to 1 h after a meal</td>
<td>1.7% (8 weeks); 4.9% (16 weeks); 5.6% (24 weeks)</td>
<td>57% (120 mg)</td>
<td>Pregnancy, chronic malabsorption syndrome, and cholestasis, and caution should be taken in patients with eating disorders, oxalate nephrolithiasis, and organ transplants</td>
</tr>
</tbody>
</table>

Note: Nonresponder rate (lost <5% of TBW).

Abbreviations: GIP, glucose-dependent insulinotropic polypeptide; GLP-1, glucagon-like peptide-1; MAO, monoamine oxidase; MEN II, multiple endocrine neoplasia, type II; TBW, total body weight.

*aMechanisms of action include augmentation of GABA-A receptors, carbonic anhydrase inhibition, antagonism of glutamate receptors.
Some medical nutrition interventions have specific disease-modifying goals, such as the Dietary Approaches to Stop Hypertension, which targets blood pressure reduction. Nutrition interventions that are overly restrictive in energy (ie, <1000 kcal/day) require close medical supervision and should only be implemented for short periods of time in patients in need of rapid weight loss for medical optimization.

**Physical activity**

Physical activity should be prescribed in all weight loss programs according to patient medical conditions, comorbidities, and baseline exercise capacity. In addition, independently of its impact on energy balance, enhancement of physical activity carries a potential for reduction of obesity-associated metabolic derangements and enhancement of lean muscle mass.

**Pharmacotherapy**

Lifestyle and behavioral modifications alone are often not sufficient to achieve sustainable, clinically significant weight loss, which is defined by a loss of >5%–10% TBW for most obesity-related health outcomes. In many patients, antiobesity medications (AOMs) play a role in sustainable intervention and are appropriate in patients with a BMI >30 or >27 with weight-related comorbidities. The role of AOMs as an adjunct to metabolic surgery is under investigation and may require additional nutrition monitoring. Patients should initiate AOMs in combination with lifestyle and behavioral modifications to augment outcomes and reduce malnutrition risk. The newest and currently most efficacious AOMs are semaglutide and tirzepatide, which are long-acting GLP-1/GIP receptor agonists. Additional AOMs regulate appetite, metabolism, and nutrient absorption (Table 1).

**General approach**

AOMs can be a useful adjunct to lifestyle modification. Older classes of medications result in an average of 5%–10% TBW loss, and newer classes result in an average of 10%–20% TBW. Medical and nutrition providers should personalize therapy recommendations based on associated medical and malnutrition risk, degree of obesity, tolerance, and patient preference. Continued follow-up should assess pace of weight loss, body composition changes, and changes in nutrition intake to achieve desired outcomes and mitigate malnutrition risk.

**Procedural interventions**

Metabolic and bariatric surgery (MBS) is an effective means of durable weight loss (Table 2). The criteria for eligibility for MBS had traditionally been a BMI >40 or BMI >35 with weight-related medical comorbidities, although patients with BMI as low as 30 can now be considered. BMI cutoffs for newer endobariatric procedures have remained >30. Although effective and safe, MBS and bariatric endoscopy can be associated with an increased nutrition risk and require careful patient selection and medical monitoring.

**Bariatric endoscopy**

Endoscopic options for weight loss include (1) gastric aspiration devices, (2) small intestinal bypass devices, and (3) endoscopic

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Metabolic procedures with corresponding indications, weight loss, and cautions/contraindications.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Procedure</strong></td>
<td><strong>Weight loss, TBW (time)</strong></td>
</tr>
<tr>
<td>Endoscopic sleeve gastropasty</td>
<td>13.6% (52 weeks); 17.2% (24 months)</td>
</tr>
<tr>
<td>Sleeve gastrectomy</td>
<td>27.2% (1 year); 23.3% (3 years); 20.4% (5 years)</td>
</tr>
<tr>
<td>Roux-en-Y gastric bypass</td>
<td>30% (1 year); 25.3% (10 years)</td>
</tr>
<tr>
<td>Biliopancreatic diversion</td>
<td>36.7% (2 years); 35.9% (5 years); 39.0% (10 years)</td>
</tr>
</tbody>
</table>

Abbreviations: BMI, body mass index; DM II, diabetes type II; NSAID, nonsteroidal anti-inflammatory drug; TBW, total body weight.
suturing procedures, such as the primary obesity surgery endoluminal procedure and the endoscopic sleeve gastroplasty (ESG). Among endoscopic interventions, ESG produces the most durable and significant weight loss outcomes (Table 2).

**Bariatric surgery**

Currently, sleeve gastrectomy (SG) is the most performed MBS. SG surgically removes approximately 80% of the stomach. The procedure accounts for a majority of bariatric surgical procedures in the United States and is appropriate for a broad range of patients (Table 2). Roux-en-Y gastric bypass is the oldest metabolic operation and involves creating a small gastric pouch and bypassing the duodenum as well as the proximal jejunum via a Y-shaped intestinal reconstruction (Table 2). Duodenal switch is the most aggressive MBS and includes a combination of SG and a long segment intestinal bypass. Because of the long length of intestinal bypass, this procedure is highly effective for long-term weight loss and remission of type 2 diabetes but carries an enhanced nutrition risk. Biliopancreatic diversion is also a therapeutic option for patients seeking further weight loss who have already had an SG.

**MONITORING AND NUTRITION RISK ASSESSMENT**

Frequent follow-up can help prevent complications of weight loss interventions. All appointments should include assessment of weight, standard nutrition guidelines and physical activity recommendations.

### TABLE 3  Screening approaches after metabolic surgery or weight loss program.

<table>
<thead>
<tr>
<th>Monitoring</th>
<th>Frequency</th>
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<tbody>
<tr>
<td>Clinic follow-up visits</td>
<td>Biweekly to monthly upon commencement, then every 3–6 months</td>
</tr>
<tr>
<td>Routine laboratory tests (CBC, BMP, LFT, magnesium, phosphorus, and lipid panel)</td>
<td>Every 6 months</td>
</tr>
<tr>
<td>Bone density scan</td>
<td>Every 2 years</td>
</tr>
<tr>
<td>24-h urine calcium</td>
<td>Annually</td>
</tr>
<tr>
<td>Vitamin B&lt;sub&gt;12&lt;/sub&gt; (folate), vitamin B&lt;sub&gt;12&lt;/sub&gt; (cobalamin), vitamin D</td>
<td>Annually</td>
</tr>
<tr>
<td>Thyroid testing</td>
<td>Annually</td>
</tr>
<tr>
<td>Fat-soluble vitamins (A, E, K)</td>
<td>Annually in BPD/DS if clinical suspicion because of symptoms of deficiency in sleeve or bypass</td>
</tr>
<tr>
<td>Vitamin B&lt;sub&gt;2&lt;/sub&gt; (thiamin)</td>
<td>If clinical suspicion because of symptoms of deficiency or elevated risk factors (female, African American, inconsistent follow-up, nausea/vomiting, furosemide use, excessive weight loss, alcohol abuse)</td>
</tr>
<tr>
<td>Trace elements (copper, zinc, and selenium)</td>
<td>If clinical suspicion because of symptoms of deficiency</td>
</tr>
</tbody>
</table>

Abbreviations: BMP, basic metabolic panel; BPD, biliopancreatic diversion; CBC, complete blood count; DDS, duodenal switch; LFT, liver function test.

### TABLE 4  Micronutrient supplementation s/p bariatric surgery.

<table>
<thead>
<tr>
<th>Micronutrient</th>
<th>Supplementation schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water-soluble vitamins</td>
<td></td>
</tr>
<tr>
<td>Vitamin B&lt;sub&gt;1&lt;/sub&gt; (thiamin)</td>
<td>12–100 mg daily</td>
</tr>
<tr>
<td>Vitamin B&lt;sub&gt;6&lt;/sub&gt; (folate)</td>
<td>400–800 mcg daily</td>
</tr>
<tr>
<td>Vitamin B&lt;sub&gt;12&lt;/sub&gt; (cobalamin)</td>
<td>350–1000 mcg daily orally or 1000 mcg IM/SQ monthly</td>
</tr>
<tr>
<td>Fat-soluble vitamins</td>
<td></td>
</tr>
<tr>
<td>Vitamin A</td>
<td>5000–10,000 IU/day</td>
</tr>
<tr>
<td>Vitamin D&lt;sub&gt;3&lt;/sub&gt;</td>
<td>3000 IU/day until 25-hydroxyvitamin D &gt; 30 ng/ml</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>15 mg/day</td>
</tr>
<tr>
<td>Vitamin K</td>
<td>90–120 mcg/day (sleeve or RYGB); 300 mcg/day (BPD)</td>
</tr>
<tr>
<td>Minerals and trace elements</td>
<td></td>
</tr>
<tr>
<td>Calcium citrate</td>
<td>1200–1500 mcg/day (s/p sleeve gastrectomy or RYGB); 1800–2400 mcg/day (s/p BPD)</td>
</tr>
<tr>
<td>Copper</td>
<td>1 mg/day (sleeve or RYGB); 2 mg/day (BDP)</td>
</tr>
<tr>
<td>Iron</td>
<td>18 mg/day (men/postmenopausal women); 45–60 mg/day (premenopausal women)</td>
</tr>
<tr>
<td>Multivitamins</td>
<td>1 tablet daily</td>
</tr>
<tr>
<td>Zinc</td>
<td>8–22 mg</td>
</tr>
</tbody>
</table>

Abbreviations: BPD, biliopancreatic diversion; IM, intramuscular; RDA, recommended daily allowance; RYGB, Roux-en-Y gastric bypass; s/p, status post; SQ, subcutaneous.
and appropriate medical testing (Table 3). Serial body composition analysis may be necessary, especially in the setting of rapid weight and muscle loss, significant intolerance of oral intake, and/or physical limitations.

**Management of patients with high nutrition risk**

Nutrition providers should screen patients at risk of weight regain as well as rapid and excessive loss leading to sarcopenia and malnutrition. Risk factors identified for weight regain include inadequate medical nutrition therapy, maladaptive eating behaviors, loss of follow-up, and minimal physical activity. Patients at elevated nutrition risk should be monitored, including older adults, patients with preexisting nutrition deficiencies, those with significant gastrointestinal symptoms leading to poor oral intake, and those with bypassed anatomies (Table 4). Although skeletal muscle loss is inevitable, sarcopenic obesity—monitoring consensus algorithms have been developed. Approaches to minimize muscle loss during weight management programming include enhancing protein intake and weight-bearing exercise.

Patients who are unable to meet their nutrition needs via an oral diet alone or have evidence of significant malabsorption after surgery may be candidates for nutrition support, including both enteral and parenteral intervention. Hospital admission may be required for nutrition initiation, especially in patients at high risk for refeeding syndrome. Revision of bariatric surgery may be required when serious complications, including malnutrition and malabsorption, occur that cannot be medically managed.

**SUMMARY**

Obesity is a chronic disease with multifactorial etiology involving social and behavioral factors, hormonal alterations, and environmental circumstances. Although initial management involves behavioral and lifestyle modifications, pharmacotherapy and procedural interventions may be necessary to produce long-lasting results. Patients are best managed in a multidisciplinary team who follow longitudinally and identify early signs of weight regain, sarcopenia, malnutrition, and nutrition deficiencies.

**CONFLICT OF INTEREST STATEMENT**

Carolyn Newberry has received speaking honorariums for Inbody and Baxter International. Jeffrey I. Mechanick has received a speaking honorarium for Abbott Nutrition and is on the advisory board and is on the advisory boards for Aveta.Life and Twin Health. Sara Hennessy is a consultant and educational speaker for Boston Scientific.

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**REFERENCES**


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