

MAIN ARTICLE

Overweight and Obesity: An Update

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Introduction

Obesity was recognized as a disease by the American Medical Association in 2013. More than two thirds (68.5%) of adults in the US are considered to be overweight or obese, with 34.9% being obese.^{1, 2, 3} Worldwide by 2030, 60% of the population will be considered overweight or obese.⁴ Approximately \$147 billion are expended annually in the US for the treatment of medical conditions related to obesity, with individual medical costs being 42% higher for an individual with obesity than for others.⁵

What do overweight and obesity mean?

Obesity is a disease categorized by excess body fat. Various measures are utilized for assessment, including body weight, body mass index (BMI), waist to hip ratio, body composition analysis, and others.^{2, 6, 7} BMI is a measure that considers someone's weight in relation to height.^{7, 8} It is calculated by taking the weight in kilograms and dividing by height in meters squared (weight kg/height m²).⁷ A BMI less than 18.5 is considered underweight; normal weight is between 18.5 and 24.9;

overweight between 25 and 29.9. The term obese is defined as a BMI of more than 30.^{2, 7}

Why? Causes of obesity - not a simple answer

The etiology of obesity is complex and scientific understanding continues to develop. Weight gain occurs when the number of calories taken in is greater than the body's energy needs; weight loss results when the body uses more calories than the number of calories taken in.⁹ As a society, our needs have changed. We no longer hunt for food, and we use motorized transportation. Increased portion sizes, high calorie

content and processed foods, compounded by lifestyle patterns that reduce activity, all impact the rates of overweight and obesity. But it is not as simple as that. Metabolic diversity exists among individuals with obesity, categorized by multiple causes, variable onsets and triggers, differences in severity, variation in distribution of fat, differing capacities to lose weight, and associated medical conditions.¹⁰

Physiology, genetics, environment, and behavior influence body weight. Control networks for hunger and fullness reside in the hypothalamus in the midbrain. Hunger and fullness are mediated by proteins that circulate as hormones in our bloodstream. Some mediators are secreted by adipose (fat) tissue, some by the stomach and other organs. Some mediators increase hunger, others reduce hunger. The mechanisms by which these proteins

regulate our hunger and satiety (the feeling of fullness) are quite complex. When we eat (or fast), input from our organ systems, nervous system, energy stores (adipose tissue), hunger and satiety mediator receptors, and endocrine stimuli all take part in hunger and fullness regulation.¹⁰

Individual tendencies toward a particular body type, either lean or obese, and body fat distribution are influenced by both genetic and non-genetic factors; genetics account for approximately 70%, while non-genetic factors contribute 30%.¹⁰ Body composition (% lean tissue vs % adipose tissue) and individual preferences toward activity or inactivity, impact energy expenditure (metabolism) or how much fuel (calories) we “burn.” Basal metabolic rate (BMR) is the amount of energy expended at rest.¹¹ Thermogenesis is the amount of heat produced by cell

functions at rest or during activity.¹⁰ Thermogenesis is more active in brown fat and skeletal muscle.¹⁰ When we eat, diet-induced thermogenesis increases the metabolic rate in response to a meal.^{10, 11} When we move, activity induced thermogenesis (either exercise-related or non-exercise activity thermogenesis) increases energy expenditure.^{10, 11}

Not all adipose tissue is the same in composition or function. In general, white adipose tissue predominates and is predisposed to certain anatomic locations (hips/buttocks, abdomen, or mixed distribution). Brown adipose tissue is associated with increased thermogenesis and has been found in skeletal muscle, cervical, supraclavicular, paraspinal, mediastinal, and perirenal depots. Brown fat declines with age, and with obesity.¹⁰ Research is ongoing related to adipose tissue types and function, as

related to health mediation and body weight regulation.

It's more than extra weight; health and quality of life are impacted by overweight or obesity

Obesity-related disease impacts all organ systems.¹⁰ Adipose tissue has highly complex functions beyond lipid storage being involved in metabolic, endocrine, immune system, and inter-organ communication.¹⁰

Excessive abdominal fat has been linked to multiple medical conditions.² In addition, satiety and hunger mediators play a role in the regulation of glucose balance, lipid metabolism, and immunity.¹⁰

Obesity is associated with reduced life expectancy¹² and medical conditions including hypertension (high blood pressure), type 2 diabetes, hyperlipidemia, coronary artery disease, sleep

apnea, non-alcoholic fatty liver disease, and certain cancers including postmenopausal breast, endometrial, cervical, and prostate cancers, as well as others.^{7, 10}

Obesity at cancer diagnosis has been linked to a higher risk of recurrence for some breast cancers.¹³ The combination of elevated triglycerides, hypertension, and elevated blood glucose, termed metabolic syndrome, increases the risk of cardiovascular disease, diabetes, and stroke.⁶

Obesity is frequently related to bodily pain, physical limitations, and fatigue. Osteoarthritis, polycystic ovarian disease, gallstones, gout, and gastroesophageal reflux are also related to obesity.¹⁴ Leg swelling can also be associated with obstructive sleep apnea.¹⁵ Mechanical pressure from abdominal obesity may increase the risk for venous thrombosis (blood clot), chronic venous

insufficiency,¹⁶ and venous stasis.¹⁷

Health related quality of life (HRQOL) is impacted and emotional costs exist as well. Symptoms of depression are known to increase with extreme obesity.¹⁸ For some, obesity may impede everyday activities and personal care.^{14, 18}

Overweight, obesity, and lymphedema

A relationship between obesity and lymphedema does exist, but the exact mechanisms that regulate this relationship appear to be multifactorial and continue to be studied. Foeldi describes the impact on the central circulation, noting that “obesity causes the diaphragm to be above its normal position, impairing its movement,” and thus the diaphragm’s role in facilitating lymph flow.¹⁹ The weight of a pendulous abdomen may impede lymphatic flow from the lower extremities.²⁰ Venous function is impaired in

the lower extremities¹⁶ and could increase the risk of phlebo-lymphedema. Massive localized lymphedema can develop in extreme obesity and may be due to local obstruction of lymphatic drainage as a result of obesity.¹⁹ Frequently, obesity accompanies lipidema and may hasten the progression to lipo-lipidema.¹⁹

Studies have shown increased body weight can impact breast cancer related lymphedema. Petrek et al. investigated women after breast cancer treatment, finding that weight gain after cancer treatment predicted lymphedema. Being overweight at the time of cancer diagnosis was also related to lymphedema risk, but to a lesser degree.²¹ Ridner et al. demonstrated that individuals with a BMI \geq 30 at the time of breast cancer treatment were 3.6 times more likely to develop lymphedema at six months or more post treatment.²²

Indeed, changes in lymphoscintigraphy are seen with obesity. Studies in individuals with obesity and no other risk factors for lymphedema have noted impaired lymphatic function with higher BMIs.^{23, 24, 25} In one study, impaired lymphatic function consistent with lower extremity lymphedema occurred with a BMI > 59 while subjects with a BMI < 54 had normal lymphatic function.²³ In a larger study, obese patients with normal lymphoscintigraphy had BMI ranges from 30.3-56.8; individuals with lower extremity lymphatic dysfunction had BMI ranges 43.9-83.0 and history of higher BMI (60.5-105.6).²⁵ A case report of a patient with lymphedema in four extremities confirmed on lymphoscintigraphy reflected a BMI history of 105.6, with current BMI of 60.3 after weight loss.²⁴ Therefore, obesity may impair lymphatic function. Several possibilities are

proposed: decreased lymph transport capacity due to compression of lymphatic vessels by adipose tissue, or from adipose-related inflammation or vessel damage; or increased lymph volume production in the enlarged limb, thus resulting in lymphedema.^{23, 24, 26}

Mehrara et al. further discuss lymphatic function being compromised by obesity, noting changes in the extracellular matrix, inflammatory reactions, and direct injury to lymphatic endothelial cells. The authors propose that lymphedema can develop because individuals with obesity exhibit impaired lymphatic function at baseline, and suggest that the pathological changes in the lymphatic system resulting from obesity may be partially reversible with weight loss.²⁶

What can be done for weight loss? All involve lifestyle changes;

multidisciplinary approach is important

For individuals who are overweight (BMI $\geq 25 < 30$), lifestyle changes (diet, physical activity, behavioral modification) should be the first intervention and can result in successful weight loss of 7%-10%, with associated improvements in weight-related health conditions.²⁷ Many programs and plans exist to assist with weight loss, but all involve sustained commitment to a healthy lifestyle.

Guidelines from the CDC include knowing your BMI and achieving and maintaining a healthy weight. Habits that include healthy eating, regular physical activity, and balancing the number of calories consumed with the number of calories used are key.² A minimal reduction in body weight in overweight and obese individuals of at least 5% to 10% of initial weight over 3-6 months is recommended.⁶ Clinical

benefits are seen with weight loss $\geq 5\%$.²⁸

Nutrition

A deficit of 3,500 calories is needed to lose one pound of body weight; cutting 500-1,000 calories daily will result in one to two pounds of weight loss per week.^{6, 29} A well-rounded diet with 15%-20% of calories from protein, 20%-35% calories from fat, and the remainder from complex carbohydrates may be helpful.²⁹ Nutrient dense foods containing high quality carbohydrates and fats are recommended.⁹ An individualized approach to the best combination of carbohydrates, proteins, and fats may be needed.⁹ Consultation with a registered dietitian can assist with the development of a personalized nutrition plan. Eating fewer than 1,000 calories a day is not recommended without medical supervision.²⁹ Fad diets may promise fast results but these limit nutrition, can be unhealthy, and

tend to fail in the long run.²

Why do diets fail? “Yo-yo” dieting; weight regain

With conscious effort, calorie intake can be reduced for a period of time, but eating behavior is regulated at a subconscious level and previous habits return.¹⁰ With weight loss, adipose tissue decreases, lowering the secretion of fullness mediators; hunger returns and weight gain recurs.^{10, 30} Metabolic rate is lower in obese individuals who maintain weight loss over time, necessitating vigilance to maintain weight loss.¹⁰

Physical Activity

Physical activity is an important component for weight loss and maintenance. While most weight loss occurs due to reduced caloric intake, evidence shows the way to maintain weight loss is to engage in regular physical activity. Calories are “burned” with

activity, and when combined with a reduction in the number of calories eaten, a calorie deficit will result in weight loss.² Physical activity also helps to reduce high blood pressure and the risk for type 2 diabetes, heart attack, stroke, several forms of cancer, osteoporosis, depression, anxiety,^{2,31} and fatigue.³²

Activity guidelines for overweight or obese individuals from the American College of Sports Medicine (ACSM) recommend a minimum of 30 minutes per day at least 5 days a week of moderate to vigorous aerobic activity (40% to < 60% progressing to ≥60% of maximum heart rate), with time increasing to 60 minutes per session, for a total of 300 minutes per week. Intermittent exercise in bouts of 10 minute, with duration accumulating to thirty or sixty minutes per day, is an effective alternative to continuous exercise.⁶ For individuals not able to

follow the ACSM guidelines, even 10 minutes of slow walking can be beneficial.²⁹

Exercising safely is important. Everyone is at a different level physically. Physician clearance should be obtained before starting an exercise program. A personal trainer with experience in exercise prescription for individuals with lymphedema and obesity can assist with exercise guidance. If pain or musculoskeletal or medical conditions exist, an assessment by a physical therapist may be needed.

Behavioral Modification

Behavioral support improves success with diet interventions.³³ Cognitive-behavioral skills involve goal setting, problem solving, functional analysis, stimulus control, relapse prevention skills, and cognitive restructuring.²⁷ A behavioral health specialist can assist with

the cultivation of strategies to identify maladaptive eating and activity behaviors, promote the development of healthy behaviors, and enhance adherence.²⁷ Both individual and group formats are beneficial.^{8, 28}

Medications

Pharmacological therapy may be used as an adjunct treatment for weight loss in carefully evaluated and selected patients.³¹ Medications approved by the FDA are for BMI ≥ 30, while several are for BMI ≥ 27 with one weight-related comorbidity.³⁴ Mechanisms of action range from decreasing fat absorption, promoting satiety, suppressing appetite, and enhancing positive behavior changes. Studies have noted a 7%-10% weight reduction over two years.³⁵

Contraindications for weight loss medications exist. Various side effects, both mild and serious,

can develop and drug interactions can occur. Caution should be used in patients over 65 years of age.³¹ Therefore, a comprehensive medical evaluation is needed to determine the risks and benefits of a particular medication with continued medical follow up to assess response.³¹

Bariatric Surgery – Weight Loss Surgery

Bariatric surgery encompasses any one of several procedures that make the stomach smaller and result in fewer calories being absorbed. It's indicated for people with clinically severe obesity who cannot lose weight by other means or have serious health problems related to obesity.^{36,37} Criteria for surgery include BMI ≥ 40 or ≥ 35 with significant obesity related health conditions; the criterion for the adjustable gastric band (only) is BMI ≥ 30 with at least one weight-related comorbidity.^{37,38} The patient must be psychologically stable

and understand the surgery type, risks, and benefits.³⁸ Long term success depends on sustained healthy lifestyle changes that involve appropriate nutrition, physical activity, and regular medical follow up.³⁷

The adjustable gastric band is a silicone device that is placed around the top of the stomach, creating a functionally smaller stomach pouch. The circumference of the band can be made smaller or larger, thus impacting the amount of food that can be taken in.³⁷ The roux en-y gastric bypass surgically reduces the size of the stomach and the absorption of nutrients and calories by bypassing a portion of the small intestine. The sleeve gastrectomy surgically reduces the size of the stomach, thus less food is taken in. Hunger is reduced in part by the smaller stomach, and by the reduction in the hunger mediator ghrelin.³⁷ While other surgical procedures are

utilized, the band, bypass, and sleeve procedures are the most common.

Bariatric surgery is a safe and effective intervention for select patients with obesity.³⁶ Patients should seek a consultation at an accredited center from a surgeon credentialed and experienced in bariatric surgery. Surgical techniques have developed with the advancement of minimally invasive procedures and hospital length of stay has decreased.³⁹ The incidence of death (.3%) and adverse events within thirty days of surgery is low.⁴⁰ When compared to usual care in individuals with obesity, bariatric surgery reduces mortality risk by 30%.³⁵

Results of weight loss surgery

Anticipated weight loss after bariatric surgery ranges from 40% to 60% of excess body weight (excess body weight = current weight – ideal

body weight).⁴¹ The benefits of bariatric surgery lie within the positive impact on health outcomes, many of which are due to the metabolic effects, in addition to the reduction in body weight.^{35, 36, 42, 43} Long term weight loss varies slightly between procedures. Roux en-y gastric bypass incurs greater weight loss than gastric band^{19, 44}; and weight loss results of sleeve gastrectomy fall between the band and bypass procedures.⁴⁵ Health benefits include prevention³⁵ and improvement of diabetes^{10, 35, 42, 46, 47, 48}; improvement of cardiac function,^{35, 49} hyperlipidemia, hypertension,^{46, 48} obstructive sleep apnea,^{35, 46, 48} and polycystic ovarian disease⁴⁸; decreased joint pain³⁵; decreased risk of first time cancer occurrence in women³⁵; and improvement of health and weight-related quality of life.^{18, 35}

Other Interventions;

New technologies and procedures, apart from surgery, are being investigated for weight loss.³⁶ One such procedure is the vagus nerve stimulator, which may assist with weight loss. The vagus nerve plays a role in satiety, metabolism and autonomic control in the upper gastrointestinal tract.⁵⁰ Another procedure is the gastric balloon, an inflatable device placed temporarily in the stomach to reduce hunger. These procedures are not yet readily available on a broad scale and require further study.

Conclusion

There is no sure method, including surgery, to produce and maintain weight loss.³⁷ A multidisciplinary approach of nutrition, exercise, and behavior modification should be the foundation of all treatments for obesity.³¹ Physicians are encouraged to broach the subject of obesity,

conduct an obesity-focused history, and offer patients the opportunity to participate in lifestyle therapy and treatment options.⁵¹

All-cause mortality is generally lowest within the BMI range of 20.0 to 24.9.¹² Weight loss in obese individuals is associated with lower incidence of health problems and death⁸; and a 5% reduction in weight can result in positive health benefits.⁵² Sustained effects on risk reduction in obese individuals after weight loss surgery require maintaining a weight loss of 10%-30%.³⁵

The mechanisms linking obesity and lymphedema continue to be studied. Lymphedema has been seen to occur in individuals with higher BMI levels.²³ Further investigation is needed to determine the impact of obesity and weight loss on lymphedema risk, signs and symptoms. Whatever the cause of

lymphedema, all individuals with lymphedema who are overweight or obese should seek a physician evaluation and treatment with a certified lymphedema therapist and engage in healthy lifestyle habits. (See NLN documents: “Healthy Habits for Patients at Risk for Lymphedema”, “Diagnosis and Treatment of Lymphedema”, “Exercise for Lymphedema Patients” and www.lymphnet.org)

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