



Review

Food as Medicine for Obesity Treatment and Management

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ABSTRACT

Purpose: Nutrition is an important lifestyle modification used in the treatment of obesity. The purpose of this review is to highlight different dietary interventions used to promote weight loss in both adults and children.

Methods: A search using PubMed was performed for articles on topics related to nutrition and management and/or treatment of obesity in adults adolescents and children. The literature was reviewed and pertinent sources were used for this narrative review.

Discussion: There are many effective nutrition interventions used to treat obesity, including altering macronutrient composition, implementing different dietary patterns, and changing meal timing. Although these interventions can induce weight loss in adults, management of obesity in children is more difficult given their varied nutrition needs in growth and development. The use of food as medicine in obesity treatment is individualized based on patient's age, food preference, and concurrent medical conditions.

Implications: Given the multifactorial etiology of obesity, treatment requires multidisciplinary care beyond nutrition intervention. (*Clin Ther.* 2022;44:671–681.) © 2022 Elsevier Inc.

Key words: Obesity, Nutrition, Diet, Management of obesity, Food.

INTRODUCTION

Obesity, defined as excess body fat or commonly recognized by body mass index (BMI) ≥ 30 kg/m², is one of the most prevalent chronic diseases worldwide.¹ Affecting >40% of US adults and ~20% of US children aged 2 to 19 years, obesity is a risk factor for >200 medical conditions, including type 2 diabetes mellitus, hypertension, osteoarthritis, depression, and, more recently, COVID-19.^{1–4}

Nutrition is an important lifestyle modification that is critical in the treatment of obesity. Although many patients are aware of various dietary recommendations to promote weight loss, prior research has not reported the best diet or dietary pattern to manage obesity. Therefore, in clinical practice, a patient's nutrition plan must be individualized based on age, food preference, cultural preference, lifestyle, and concurrent medical

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diseases. In this discussion of “Food as Medicine,” the most popular nutrition interventions to manage obesity in adults, adolescents, and children are reviewed.

MATERIALS AND METHODS

Following the recommendations of the Center for Reviews and Dissemination for performing reviews in health care, we determined inclusion criteria based off of the PICOS (Population, Intervention, Comparators, Outcomes, Study Design) format. We systemically searched the PubMed database for relevant human studies. Search terms included “nutrition AND obesity AND adults,” “nutrition AND obesity AND pediatrics OR children OR pediatrics,” “diet AND obesity AND adults,” and “diet AND obesity and pediatrics OR children OR pediatrics.” Although the majority of this review includes systematic reviews and meta-analyses, special attention was given to randomized controlled trials that evaluated specific dietary interventions, including macronutrient composition, dietary patterns, and meal timing (i.e. intermittent fasting) in particular subpopulations of children, adolescents, and adults with obesity.

NUTRITION IN ADULTS

Weight Loss

The goal of nutritional intervention in the treatment and management of obesity is to induce weight loss by creating a negative energy balance using one of the following strategies:⁵ (1) reduce calorie consumption by 500 to 750 kcal/d; and (2) limit total caloric intake to 1200 to 1500 kcal/d for women and 1500 to 1800 kcal/d for men. The diet should be adjusted to reduce excessive energy intake and enhance dietary quality to increase the likelihood of achieving recommendations in the 2020 to 2025 Dietary Guidelines for American.^{5,6} This is achieved via numerous dietary changes that include alterations to macronutrient composition, specific dietary patterns, and changes to meal timing.

Macronutrient Composition

Macronutrient composition refers to the relative contribution of macronutrients, namely protein, carbohydrates, and fat. Altered macronutrient composition and the quality of dietary macronutrients often shift mediators of caloric intake and diet sustainability, such as satiety and fullness, with the goal to improve adherence to an energy-restricted diet. The

2013 American Heart Association/American College of Cardiology/The Obesity Society guidelines for management of overweight and obesity in adults showed that alteration in macronutrient composition produced a weight loss of -4 and -12 kg at the 6-month follow-up.⁷

Higher Protein. Higher protein diets have long been considered advantageous for weight loss, often in conjunction with low-fat or low-carbohydrate diets.⁸ These diets generally consist of 20% to 30% of energy intake supplied by protein, whereas “normal protein” diets derive 10% to 15% of energy from protein.^{9,10} Protein has a high thermogenic advantage over carbohydrates and fat in that a substantial 20% to 30% of protein-derived calories are used by the body in digestion, transport, and storage processes rather than being metabolized, thus presumably creating a larger energy deficit.^{10,11} In addition, studies have shown that satiety associated with protein intake is greater than with other macronutrients, and fullness ratings increase with protein intake.^{9,10,12} This is due to multiple factors, which include circulating amino acid levels and secretion of anorexigenic gut hormones. Higher protein diets also preserve lean body mass during weight loss better than normal protein diets.^{9,13}

Studies have suggested that higher protein diets are effective in producing modest weight loss among adults under ad libitum feeding and energy-restricted conditions, with satiety playing an important role in decreasing volitional energy intake.^{9,10} Similar weight loss efficacy has been observed using plant and animal sources of protein.^{9,14} Although one study showed that an energy-restricted higher protein diet achieved a 3.6 kg loss on average at 24 months, a meta-analysis actually showed that differences in weight loss between higher and normal protein isocaloric diets are not significant.¹⁵⁻¹⁷ Furthermore, although higher protein diets may induce greater weight loss compared with low-fat or low-carbohydrate diets during the first 3 to 6 months of the intervention, the differences attenuate and are no longer significant when compared over 12 to 24 months.^{9,10} Therefore, dietary adherence and energy restriction are primary drivers of long-term weight loss, rather than an inherent association with higher protein intake.

Carbohydrate Quality. The quantity and quality of carbohydrates are of great interest in the treat-

ment and management of obesity. According to the carbohydrate-insulin model of obesity, carbohydrates elevate insulin secretion, thereby directing fat toward storage in adipose tissue.⁸ Carbohydrate quality is a function of several variables, including glycemic index and load, fiber quantity, and the presence of added sugars during processing.⁵ We examine the evidence underlying interventions concerning both the quality and quantity of dietary carbohydrates.

Glycemic Index and Load. Glycemic index refers to a quantification of how responsive blood glucose is to consumption of a particular carbohydrate product, relative to a reference. A product's glycemic load is defined as the product of its glycemic index and the quantity of carbohydrates, thereby reflecting the total blood glucose-raising potential of that dietary intake.¹⁸ It has been hypothesized that the rapid rises and declines in blood glucose and subsequent hormones associated with high glycemic index foods may increase food intake and self-reported hunger, as well as preferentially lead to carbohydrate over fat oxidation postprandially.^{18,19} Currently, there is no standard definition of a low glycemic index or low glycemic load diet,⁵ but it is theorized that lower glycemic index/load foods promote satiety to minimize postprandial insulin secretion and maintain insulin sensitivity.¹⁹

Although lower glycemic index diets are associated with benefit for other chronic diseases, including type 2 diabetes mellitus and coronary artery disease, evidence from both observational and intervention trials comparing low and high glycemic index foods for weight loss among adults with obesity have been mixed and limited.²⁰ Studies using isocaloric control diets have generally shown similar weight loss produced by low and high glycemic index diets at 6 months and beyond, which precludes practical guidance on the efficacy of glycemic index-based interventions for weight loss.^{18,21,22}

Added Sugars and Sugar-Sweetened Beverages. Added sugars are defined by the US Food and Drug Administration as sugars added during the processing of foods, foods packaged as sweeteners, sugars from syrups and honey, and those from concentrated fruit or vegetable sources, with a recommended daily value of <10% of total calories or 50 g/d for adults.²³ However, US adults consume well over 15% of total energy, with sugar-sweetened beverages accounting for nearly 50% of added sugars.²⁴ Studies have suggested that

calories consumed in liquid form are associated with less postprandial satiety compared with calories from solid food sources, likely due to a lack of dietary fiber and rapid transit through the digestive tract.^{18,25} This reduced satiety along with high-energy density, higher palatability due to sweetness, and reduced perception of energy consumption may drive the association of sugar-sweetened beverages with weight gain and obesity.^{18,24}

There is ample scientific evidence to support the understanding that reduced consumption of added sugars and sugar-sweetened beverages is associated with weight loss.^{25,26} Most recently, a large randomized trial in adults aged 18 to 40 years with a BMI from 18.5 to 40 kg/m² showed that consumption of sugar-sweetened beverages was associated with weight gain (4.4 [1.0] kg) compared with artificially sweetened beverages (0.5 [0.9] kg) or unsweetened beverages (−0.2 [0.9] kg).²⁷ However, population-based modeling studies predict that reductions in sugar-sweetened beverage consumption would reduce the prevalence of obesity nationally by an estimated range of 0.3% to 1.7%.^{27,28} Therefore, reduction in added sugar and sugar-sweetened beverage intake is strongly recommended in the treatment and management of obesity in adults.

Dietary Fiber. Dietary fiber is classified into insoluble and viscous soluble fiber. Insoluble fiber is important for stool bulking and colonic health, whereas viscous soluble fiber has numerous cardiometabolic benefits, especially with intake of 14 g of total fiber per 1000 kcal daily.^{29,30} Common dietary sources of fiber include whole grains, fruits, vegetables, legumes, nuts, and dietary supplements. Viscous fiber is important in appetite regulation, by increasing viscosity and decreasing energy density of food, delaying gastric emptying, blunting energy metabolism from absorbed macronutrients, and modulating appetite-suppressing hormones.^{31,32} Therefore, dietary fiber is believed to be a key tool in increasing satiety and satiation, and thus in maintaining a caloric deficit.^{31, 32}

The randomized trial POUNDS Lost (Preventing Overweight Using Novel Dietary Strategies) trial studied 345 participants (53.9% female) with a mean age of 52.5 (8.7) years and a mean BMI of 32.6 (3.9) kg/m² and assessed the role of dietary fiber as a predictor for weight loss.³² The mean weight loss at 6 months was −7.27 (5.6) kg, with fiber intake being the most influential predictor for weight loss compared

with caloric density and fat, carbohydrate, and protein content. This finding was further supported by a recent meta-analysis which showed that dietary viscous fiber improved body weight and parameters of adiposity, independent of caloric restriction.³¹ In sum, dietary fiber is a potent tool for the management of obesity and common cardiometabolic comorbidities.

Low Carbohydrate. Reduction in the quantity of carbohydrate intake is one of the most well-known dietary interventions for obesity. The Academy of Nutrition and Dietetics defines low-carbohydrate diets as those restricted to no more than 20 g/d of carbohydrates, without restriction on other macronutrients or total energy.⁵ However, others consider a 20 g/d restriction to be a very low carbohydrate ketogenic diet, with a general low-carbohydrate diet defined as $\leq 20\%$ to 45% of daily energy intake from carbohydrates.²²

It has been hypothesized that low-carbohydrate diets may be associated with increased satiety and decreased hunger. The carbohydrate-insulin model has become increasingly popular in scientific literature surrounding nutrition and obesity. As mentioned previously, the carbohydrate-insulin model proposes that high-carbohydrate diets may lead to greater weight gain because of their tendency to increase insulin secretion, which favors adipose storage and decreases fat oxidation by metabolically active tissues.^{11,33} This leads to an adaptive decrease in metabolic rate, thereby leading to weight gain.

A large meta-analysis of adults with obesity concluded that low-carbohydrate diets (<40% of total energy) promote a 6.8 kg decrease in body weight on average after 6 months.³⁴ However, weight loss with low-carbohydrate diets is not significantly superior in efficacy to isocaloric diets, with higher carbohydrate content, or to isocaloric low-fat diets by 12 months of dietary change.^{5,7,14,18,33,34}

Low-carbohydrate diets may be associated with lower triglyceride levels than low-fat diets, with unclear effects on other cardiometabolic markers.³⁵ In addition, adherence patterns are similar between low-carbohydrate and low-fat diets, although more adverse effects, including constipation, headache, muscle cramps, and diarrhea, are observed with low-carbohydrate diets compared with low-fat diets.^{14,36} Therefore, it is increasingly understood that higher quality carbohydrate sources, such as those with other important nutrients and substances, including fiber,

vitamins, minerals, low glycemic index, and no added sugars, may confer more substantial benefit in the treatment of obesity, given the lack of clear benefit of strictly low-carbohydrate diets compared with other effective energy restriction methods.³³

Low-Fat. Low-fat diets are those that contain < 30% of total daily calories from fat and are typically energy restricted.⁷ Mechanisms that contribute to weight loss through low-fat diets are multifactorial, including reducing consumption of dietary fat. Therefore, following an isocaloric energy-restricted low-fat diet allows for increased volume consumption of carbohydrates and protein, thereby improving satiation while maintaining a total caloric deficit.²² In addition, high dietary fat consumption is hypothesized to potentially lead to weight gain through multiple molecular mechanisms, including alterations to intestinal microbiota, decreased fatty acid oxidation, and decreased gut hormone secretion of glucagon like peptide-1 and peptide YY, leading to low satiety and insulin resistance.³⁵

Low-fat diets have been similarly well studied and shown to be effective in producing weight loss among adults with obesity. The Diabetes Prevention Program (DPP) reported 12-month weight loss to be ~ 7.1 kg, with meta-analyzed data suggesting that ad libitum low-fat diets may also produce weight loss, although likely less efficaciously.²² However, the reductions in weight seen using a low-fat diet among adults with obesity are similar to those of a low-carbohydrate diet, with no clearly demonstrated large-scale advantage in efficacy, sustainability, adherence, or cardiometabolic protection.^{7,14,22,35,36} Notably, although satiety and fullness may be modulated by gastric distention and ingested volume, perceived diet satisfaction overall is generally higher in high-fat diets.³⁵

Dietary Patterns. There is a large variety of dietary patterns that can be used as interventions for chronic disease and obesity management. Each type focuses on different dietary components to accomplish patient goals.³⁷ The three patterns reviewed are the Mediterranean diet, Dietary Approaches to Stop Hypertension (DASH), and select exclusionary diets, including the vegan, vegetarian, and pescatarian diets.

Mediterranean Diet. The Mediterranean diet is a dietary pattern that is based on the eating habits of those who live in the Mediterranean Basin whose diets

primarily comprise native plants and seafood found in the surrounding sea.^{38,39} The Mediterranean diet is defined by its lowered intake of saturated fats and increased intake of vegetable oils; those adhering to this diet prioritize olive oils, vegetable and plant products (eg, leafy green vegetables, fruits, nuts, legumes), whole grain cereals, and fish and other seafoods.⁴⁰ The Mediterranean diet also includes moderating intake of meat and dairy products and decreasing consumption of sugar and processed foods.^{40–42} The nutritional profile tends to have higher fat and lower carbohydrate levels compared with a traditional western diet. In addition, the Mediterranean diet promotes increased consumption of dietary fiber, antioxidants, and omega fatty acids.⁴³ Currently, the Mediterranean diet has been shown to be an effective preventative measure and supplementary treatment for cardiovascular disease, stroke, hypertension, and cancer.^{42,44–48}

The Mediterranean diet promotes weight loss and improves metabolic abnormalities in combination with caloric restriction or when combined with increased physical activity.²² A meta-analysis of 16 randomized controlled trials showed weight reduction by a mean of 1.8 kg compared with control diets over course of 1 to 60 months.²² The ongoing PREDIMED (Prevención con Dieta Mediterránea)-Plus trial has enrolled 7000 participants who were randomized to either an energy-restricted Mediterranean diet (in combination with physical activity and lifestyle counseling) or a usual-care control group. The mean weight loss after 1 year was 3.2 kg in the intervention group vs 0.7 kg in control participants.²²

DASH Diet. The DASH diet refers to a diet proposed after the 1997 DASH Study.⁴⁹ DASH focuses on high-protein, high-fiber, and low-fat intakes to lower blood pressure in patients experiencing or beginning to experience hypertension. DASH diet guidelines include increasing consumption of fruits, vegetables, legumes, lean meats, whole grains, and low-fat dairy products as well as moderating sodium intake.^{50–52} Although intended for treating and preventing hypertension, the DASH diet has been shown to lower cardiovascular disease, stroke, and type 2 diabetes. In a meta-analysis completed by Ge et al,³⁶ the DASH diet promoted a mean 3.63 kg weight loss compared with a usual diet.³⁶

Exclusionary Diets. Exclusionary diets include diets that restrict entire food groups. The vegan diet restricts consumption of animals and all animal products, including any meat, seafood, dairy, and

eggs.⁵³ A common vegetarian diet, similar to the vegan diet, restricts intake of animal flesh but permits consumption of other animal products, including dairy or eggs.⁵⁴ The pescatarian diet integrates fish and seafood into a common vegetarian diet. Both vegan and vegetarian diets are plant based and have the potential to be nutritious, sustainable diets.⁵⁵

Plant-based diets that consciously focus on unprocessed foods, decreased consumption of sugar and saturated fats, and maintaining proper intake of protein and various vitamins have some benefits in health measures, including decreased BMI and inflammation.^{55–58} However, the range of nutritional quality of plant-based diets is considerably large. Education and economic status play a significant role in how nutritionally wholesome a plant-based diet may be, and access to that education and fresh produce can dramatically change the nutritional profile of a plant-based diet.⁵³ Without proper supplementation, plant-based diets can lack nutrients such as iron, vitamin B₁₂, and calcium.^{59–61} In addition, unplanned or ill-informed vegan and vegetarian diets can be made of heavily processed foods, leading to weight gain.^{62,63} Therefore, careful consideration and planning are important in considering these diets as a means for obesity treatment and management. However, vegetarian-based diets in combination with energy restriction have shown significant weight loss compared with nonvegetarian-based diets.^{64–66}

Meal Timing. Meal Timing (ie, intermittent fasting) is another approach to promote weight loss and metabolic benefits that is comparable to a standard daily energy restriction. Various types of intermittent fasting have been described in the literature that include alternate-day fasting, 5:2 intermittent fasting, and time-restricted feeding.⁶⁷

Alternate-Day Fasting. The alternate-day fasting consists of severe dietary restriction during alternating days and as much food as necessary in the eating days, ad libitum. Any permitted energy during fasting days is provided in a single meal. Trepanowski and colleagues⁶⁸ compared the alternate-day fasting diet with a daily energy restriction of 25% among 69 adults with obesity in a 6-month period. The fasting day consisted of a single meal containing 25% of energy requirements consumed between the time of noon and 2:00 PM and 125% of energy requirements on feeding days. A similar body mass loss (fat and lean mass) of

6.8% between the 2 groups was observed. Metabolic health markers such as triglycerides, adipokines, fasting glucose, and insulin resistance were unaffected by either intervention.⁶⁷⁻⁶⁹ Thus, alternate-day fasting does not seem to be superior to daily energy restriction.

5:2 Intermittent Fasting. The 5:2 diet consists of 2 days of severe (up to 75%) energy restriction per week with ad libitum food consumption on the remaining 5 days.⁶⁷ When diet restriction for 2 nonconsecutive days was compared with a daily energy restriction of 25% in young women with overweight, Harvie and colleagues reported similar body mass and fat mass reductions, along with modest reductions in fasting insulin and insulin resistance in both groups.^{67,70} Another study by Antoni and colleagues reported that the 5:2 approach, with 2 restrictive consecutive days, showed similar body composition and fasting biochemical outcomes compared with daily energy restriction.^{67,71}

Daily Time-Restricted Feeding. Daily time-restricted feeding requires only awareness of the time at which eating occasions occur. It aims to keep food intake within an 8- to 10-hour window and a 14- to 16-hour overnight fast. This approach results in decreased fat mass and leptin but no significant difference in the resting energy expenditure. Evidence suggests that extended fasting intervals influence fat mass, particularly when the fasting has been extended to at least 16 hours. However, the long-term impact of this approach in metabolic health and weight loss remains to be elucidated.⁶⁷

Weight Maintenance

Although weight maintenance is not clearly defined, the duration of 1 year is often used. Long-term weight maintenance is particularly difficult for the majority of patients who lose weight due to biologic compensatory mechanisms (including hormonal changes) that promote weight regain and an obesogenic environment found in many developed countries that is saturated with inexpensive, calorie-dense and highly processed foods that lead to increase appetite and overconsumption. Many studies estimate that more than one half of weight lost is regained within 2 years, and nearly 80% is regained within 5 years.⁷²

Food and the practice of healthy eating are essential to weight maintenance. By choosing foods that are nutrient dense, improved satiety and weight stability can be achieved. In general, adherence to a low-calorie diet that incorporates fruit, vegetables, healthy fat,

protein, and whole-grain carbohydrates is effective for weight maintenance.⁷³ This principle can be achieved by consuming more home-cooked meals using unprocessed whole foods and/or eating smaller, more frequent meals.^{74,75}

The National Weight Control Registry (NWCR) is a cross-sectional study of 2959 subjects who maintained weight loss of at least 30 pounds for 1 year.⁷⁶ Consistent nutrition strategies used to aid in weight maintenance include consuming a low-calorie, low-fat diet and eating breakfast regularly. On average, subjects consumed 1381 kcal/d with 24% of calories from fat. Registry members also report eating ~2.5 meals weekly in restaurants and <1 meal weekly in a fast food establishment. In addition, 78% of subjects in the NWCR ate breakfast daily. Other behaviors important to weight maintenance are frequent monitoring of food intake, weighing oneself at least once a week, and engaging in a high level of physical activity.⁷⁶

Nutrition in Pediatrics and Adolescents

The effects of obesity are important to consider across the life span as obesity affects the physical and psychological health in children and adolescents.⁷⁷ Starting in the womb, expectant mothers with obesity carry an increased risk for their offspring to develop obesity and other weight-related conditions.⁷⁸ The most rapid period of weight gain has been shown to occur during the early years between ages 2 and 6 years.⁷⁹ Excessive weight gain that occurs over childhood is generally due to an imbalance of calories-in vs calories-out. Many clinical trials in the pediatric population have targeted behavioral interventions, including diet and physical activity, to address this imbalance of more calories-in than calories-out.⁸⁰ Systematic reviews of these behavioral interventions alone reliably show small reductions in BMI and BMI z scores compared with control groups.^{45,80-82} Therefore, obesity in childhood is best treated with a multifaceted approach that includes behavior change, as well as consideration of pharmacologic and surgical therapies.⁸¹

Dietary changes in children and adolescents, although first-line, are often difficult to achieve and sustain. Nutritional goals beyond the newborn period vary by age as growing children need differing amounts of protein, carbohydrates, and fat. Therefore, specific nutrition recommendations for weight management

also vary according to age of development.⁸² Dieting in children should also be handled with caution and overseen by a clinician as part of a supervised medical program given the association of fad diets and other restrictive food intake behaviors with significant risks, including disordered eating.⁸³ In addition, many children with obesity benefit from slowed weight gain rather than frank weight loss during times of vertical growth and pubertal change.⁸⁴

The data on optimal diet prescriptions for the treatment of childhood obesity are limited.^{85,86} Longitudinal data sets tracking food consumption and weight over time have shown that excess weight gain is associated with consumption of fat spreads (eg, butter and margarine), coated poultry and fish (ie, battered), potatoes prepared in oil (including French fries and potato chips), desserts, and sugar-sweetened beverages.⁸⁷ Conversely, weight loss over time is associated with the intake of whole grains and high-fiber cereals.

Clinical trials have shown that the likelihood of achieving clinically significant weight loss (defined as a decrease in BMI z score of ≥ 0.2 unit/1 year) is associated with younger age, mild to moderate forms of obesity at the time of intervention, and reduced consumption of sugar-sweetened beverages.⁸⁸ These findings highlight the importance of implementing prevention and treatment measures early when habits are still being formed and lifestyle modification may be most effective.⁸⁹

School-based interventions have positively affected the quality of foods consumed. The Healthy, Hunger-Free Kids Act, which was implemented in 2012, requires that at least 51% of grains be whole grains and that each student takes at least one-half cup serving of fruits or vegetables per meal.⁹⁰ The US Department of Agriculture supports the daily intake of a total of 9 servings of fruits and vegetables daily.⁹¹ These recommendations were implemented into the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) food packages in 2010. Since the implementation of these changes, the incidence of obesity has decreased from 15.9% in 2010 to 13.9% in 2016 among children ages 2 to 4 years enrolled in the WIC program.⁹²

Similar to weight loss in adults, weight loss in children and adolescents can occur with decreased energy consumption independent of macronutrient distribution.⁹³ Recent recommendations by Brown

and Cuda⁹³ suggest tailoring macronutrient content to address specific obesity-related complications, but further research is necessary. In general, the choice of macronutrient choice should be individualized to the particular child or adolescent via shared decision-making with the patient's family.

CONCLUSION

Obesity is a complex, multifactorial disease that requires multidisciplinary care for treatment and prevention. Although the foundation of management involves food, in terms of quality and quantity, the perception that obesity is solely addressed through creation of a negative energy balance via diet and physical activity undermines the role other factors, including genetics, environment, and physiology, have in disease development. Depending on disease severity, other tools such as behavior modification, pharmacotherapy, and surgery are essential to obesity treatment.

Throughout the discussion of "Food as Medicine," there is no emphasis on one particular diet or eating pattern to promote weight loss. Multiple studies illustrate that the best nutrition practice is one that is sustainable long term. Therefore, a shift to focus on diet quality with increased micronutrient density and consumption of less ultra-processed foods are key to achieving satiety, weight loss, and eventual weight maintenance. In the future, precision nutrition may assist in promotion of one dietary pattern over another based on an individual's genetic background, race, or sex.

DECLARATION OF INTEREST

None declared.

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All authors contributed to drafting and revising manuscript, and all authors approved the final version of the manuscript to be published.

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