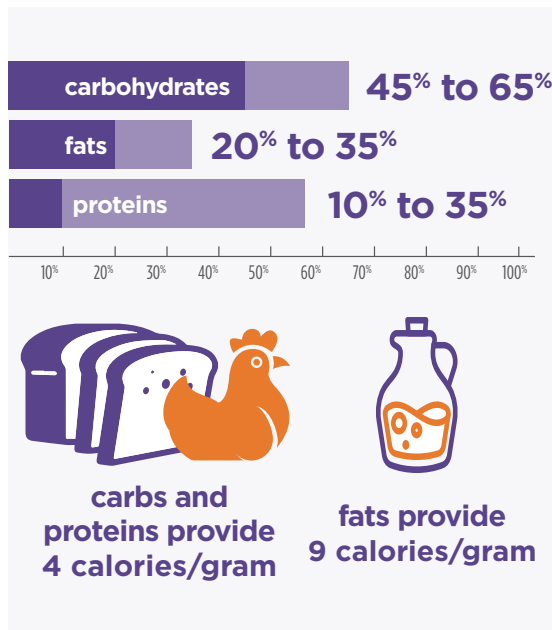


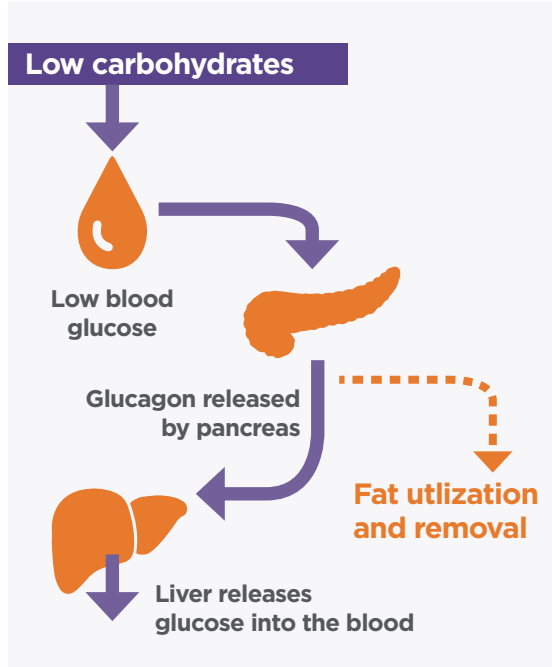
Introduction

Nutrition and health are inextricably linked since, biologically, our nutritional intake largely defines our growth, development, and overall health.¹ Health promotion and disease prevention are achieved through a lifestyle approach that includes physical activity and dietary patterns that are energy-balanced and nutrient-dense.² While most clinicians recognize the risks of poor nutrition, they lack the training to provide effective nutrition counseling. Consequently, this second monograph in the series from the American Academy of Physician Assistants (AAPA), sponsored by Abbott, will focus on some of the most popular eating plans today. In addition to describing the eating plans, the available science behind many of the eating plans and data on their effectiveness will be summarized. While many eating plans are discussed below, the list is not exhaustive.



Macronutrient-based Eating Plans

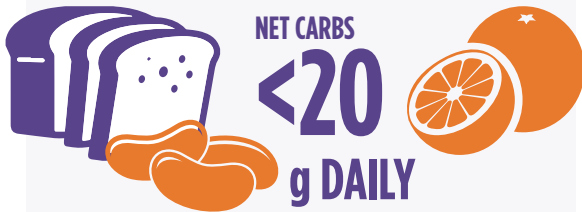
The Institute of Medicine, a non-profit, non-government organization that provides independent, objective analysis and advice to the nation, generally recommends that an adult's diet consist of 45% to 65% carbohydrates, 20% to 35% fats, and 10% to 35% protein.³ Each macronutrient provides a fixed amount of dietary calories per gram—carbohydrates and proteins each provide 4 calories per gram, while fats provide 9 calories per gram.⁴ Macronutrient-based approaches seek to control the ratio of the different macronutrients in a given eating plan. The ratio is individualized based on a person's goal—those involved in high-intensity training may increase the carbohydrate-to-protein ratio while those who desire weight loss may decrease the carbohydrate-to-protein ratio.⁵ **The rationale for macronutrient-based eating is that counting calories (ie, portion control) alone does not take into consideration the types of food a person is eating.** It is important to note that it is not advisable, or even feasible, to eliminate an entire macronutrient category from an eating plan. Several popular macronutrient-based approaches are described in the coming pages.



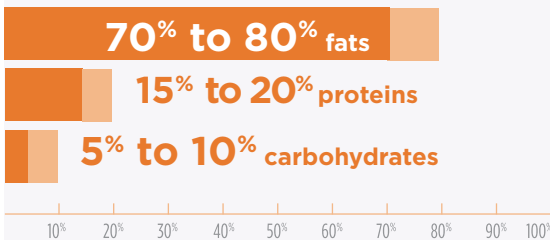
Carbohydrate-limiting Eating Plans

All carbohydrate-limiting eating patterns limit carbohydrates to some degree, as well as the amount of protein and fats. Biochemically, by reducing consumption of dietary carbohydrates, the body limits the amount of insulin that is released by the pancreas.⁶ **Therefore, low-carbohydrate eating patterns attempt to reduce insulin release and increase the release of glucagon, thereby discouraging energy storage (fat creation and storage) and encouraging energy expenditure (fat utilization and removal).**⁷ However, this concept has been challenged, rather suggesting that “a calorie is a calorie” related to body fat and energy expenditure when comparing carbohydrates to fats.⁸

MACRONUTRIENT-BASED EATING PLANS / Carbohydrate-limiting Eating Plans



**DIETARY CALORIC
 REQUIREMENTS FOR WEIGHT LOSS**



The Ketogenic Diet

Get Started⁹

- Net carbohydrates <20 g daily
- Few fruits except those with high dietary fiber (eg, berries, avocados)
- Leafy green vegetables with limited high-carbohydrate content vegetables (eg, carrots, peppers)
- Starches mostly eliminated

Tips¹⁰

- May be undesirably high in saturated fat and may be low in vitamins, minerals, and fiber
- Can be difficult to maintain long term because of the rigidity

The Results

A meta-analysis of 13 studies of the ketogenic diet lasting for at least 12 months found:¹¹

- Weight loss, decreased postprandial triglycerides and diastolic blood pressure, and increased low-density lipoprotein cholesterol (LDL-c) and high-density lipoprotein cholesterol (HDL-c)

Hungry for More

A diet high in fats and low in carbohydrates causes ketosis,⁹ a process that occurs when the body lacks sufficient access to glucose and breaks down stored fats, and is thus known as the ketogenic diet. All properly designed ketogenic diets utilize fats as the primary source of dietary calories and restrict carbohydrates and proteins. In these diets, carbohydrates are generally kept below 20 g daily.⁹ Since fiber is indigestible and not used as a fuel source, the number of grams of fiber is deleted from the total grams of carbohydrates in a food to get what is popularly known as the net carbohydrates.⁹ When used for weight loss, the ketogenic diet typically provides approximately 70-80% of calories from fats, 15-20% from proteins, and 5-10% from carbohydrates.¹² Higher levels of circulating ketones, indicating break down of stored fats, have been observed in individuals consuming greater percentages of calories from fats and less from carbohydrates.¹³

MACRONUTRIENT-BASED EATING PLANS / Carbohydrate-limiting Eating Plans

6-8 servings of vegetables



3 servings of protein



2-4 servings of added fats



The Atkins Diet®

 **Get Started**¹⁴

- Focus on portion control
- After an induction and balancing phase or in the modified Atkins 40 and Atkins 100, the plans recommend:
 - 20 to 100 grams net carbohydrates based on goals
 - 6 to 8 servings of vegetables
 - 3 servings of protein (4 to 6 ounces)
 - 2 to 4 servings of added fats (1 Tbsp each)

 **Tips**¹⁰

- Can be undesirably high in saturated fat and low in vitamins, minerals, and fiber
- May not be practical long term

 **The Results**

Systematic reviews of the Atkins diet suggest that it is associated with:

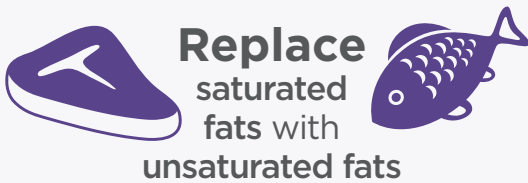
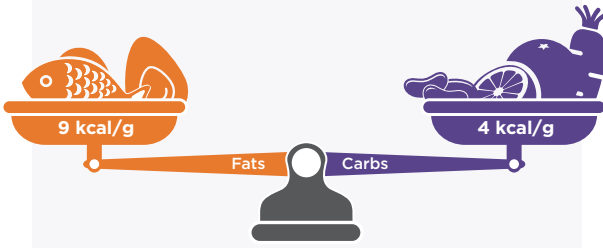
- Clinically meaningful short-term (3 to 6 months) weight loss¹⁵ and modest long-term (≥12 months) weight loss^{15,16}
- Favorable effects on systolic and diastolic blood pressure, HDL, triglycerides, and fasting insulin¹⁶

Hungry for More

For individuals who wish to maintain weight, 100 grams of net carbohydrates split between three meals and two snacks is suggested.¹⁴ For those who desire weight loss up to 40 pounds, 40 grams of net carbohydrates are recommended.¹⁴ For individuals who have more than 40 pounds to lose, or have pre-diabetes or diabetes, the eating plan is separated into four distinct phases that control the amount and type of carbohydrates more tightly in the early phases and mimic the weight maintenance phase described above in phase four.¹⁴



MACRONUTRIENT-BASED EATING PLANS / Fat-limiting Eating Plans



*“In effect, we have come to realize that **not all fats are created equal.**”*

Fat-limiting Eating Plan

A fat-limiting plan is often referred to as a high-carbohydrate, low-fat (HCLF) diet. The total fat intake is limited to roughly 20 grams per day or less, although the absolute amount may vary based on the specific diet.^{10,17}

The fundamental biochemical basis for a HCLF diet is related to the relative energy density of the two macronutrients. Replacing high-energy content fat (9 kcal/g) with lower energy content carbohydrate (4 kcal/g) would reduce overall caloric intake if the total mass consumed remained the same.¹⁰

Thus, in the past, most dietary guidance centered on the reduction of fat intake. Recently, the focus has shifted from fat elimination to fat choice.¹⁸ Saturated fats should be replaced with poly-unsaturated fats and industrial trans fats should be avoided entirely to reduce the risk of coronary artery disease.¹⁸ In effect, we have come to realize that not all fats are created equal.

The Ornish Diet

Get Started¹⁹

- Plant-based eating focused on small, frequent meals and portion control
- Fruits, vegetables, whole grains, legumes, and soy
- Proteins are derived in the form of tofu, tempeh, beans, and legumes
- Egg whites and up to two servings of low-fat dairy permitted
- Meat, poultry, and fish are restricted
- Limited sugar (two servings/day) and alcohol (one serving/day)
- No more than 10% of calories from fats
- 4 grams of fats per day come from fish oil, flax seed oil, plankton-based omega-3 fatty acids, nuts, or seeds

Tips¹⁰

- Can be low in calcium
- May be difficult to follow long term

The Results

Two studies have found:^{15,20}

- Short- (<6 months) and long-term (12 months) weight loss
- Reduction in total cholesterol, LDL-c, and LDL/HDL cholesterol ratio at 1 year

At a Glance

MACRONUTRIENT-BASED EATING PLAN

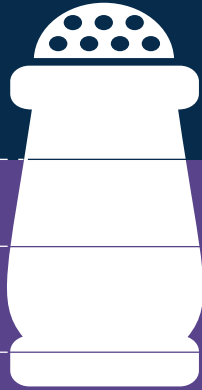
EATING PLAN	DESCRIPTION	BENEFITS	CONSIDERATIONS
Ketogenic	-70-80% of calories from fat, 15-20% from proteins, and 5-10% from carbohydrates ¹²	↓ weight, triglycerides, diastolic blood pressure ¹¹ ↑ LDL-c, HDL-c ^{11,*}	↑ saturated fat ↓ vitamins, minerals, fiber ¹⁰
Atkins	6 to 8 servings of vegetables, 3 servings of protein (4 to 6 oz), 2 to 4 servings of added fats (1 Tbsp) ¹⁴	Clinically meaningful ↓ short-term weight, ¹⁵ modest ↓ long-term weight ¹⁶	↑ saturated fat ↓ vitamins, minerals, fiber ¹⁰
Ornish	<ul style="list-style-type: none"> • Proteins are derived in the form of tofu, tempeh, beans, and legumes • Meat/poultry restricted • <10% of calories from fats⁹ 	↓ weight, LDL/HDL cholesterol ratio ^{15,20}	Difficult to follow long term ↓ calcium ¹⁰

* LDL also increased in this meta-analysis. In the context of the study, HDL also increased and total triglycerides decreased, suggesting the LDL increase may not be a negative outcome. Furthermore, evidence from keto diet studies show the LDL increase is predominately the lower-density, larger-particle, type-A LDL, which is not associated with an atherogenic effect.

A typical American diet may contain **3,400 mg** of sodium or more daily

The DASH diet sets a limit of **2,300 mg daily**

A more stringent version of this diet sets the sodium limit to **1,500 mg daily**



Hungry for More

More than twenty years ago, the New England Journal of Medicine published the Dietary Approaches to Stop Hypertension (DASH) diet, a balanced-nutrient, moderate-calorie approach based on a clinical trial that assessed specific dietary patterns on blood pressure.²² It was, and still is, considered an important advancement in nutritional science. Importantly, the diet reduces sodium intake—while a typical American diet may contain 3,400 mg of sodium or more daily, the DASH diet sets a limit of 2,300 mg daily. More recently, the American Heart Association recommends a more stringent version of this diet that sets the sodium limit to 1,500 mg daily,²⁴ but the appropriate target depends on an individual's cardiovascular health needs. While DASH is technically not a reduced-sodium diet, its effects are enhanced by also lowering sodium intake.²²

Pattern-based Eating plans

Unlike macronutrient-based approaches that focus on macronutrient ratios, a pattern-based approach is predicated on overall eating patterns that have important benefits and supply adequate nutrients within energy needs. According to the Academy of Nutrition and Dietetics in its newly-updated position paper, dietary pattern is more important to a healthy diet than focusing on single foods or macronutrients.²¹ Psychologically, a dietary pattern approach tries to avoid labeling foods as either “good” or “bad” in an overly simplistic manner because labeling a desired food as “bad” may cause people to abandon efforts towards a healthy diet. Indeed, a 2011 survey found that 82% of US adults cited not wanting to give up foods they like as a reason for not eating healthier.²¹ Moderation and proportionality in the context of a healthy lifestyle are key components of any dietary pattern-based approach.

DASH



Get Started²²

- Vegetables, fruits, and whole grains
- Fat-free or low-fat dairy
- Fish, poultry, beans
- Nuts and vegetable oils
- Limit of 2,300 mg sodium daily
- Limit foods high in saturated fat, full-fat dairy, tropical oils (eg, coconut, palm), sugar-sweetened beverages, and sweets



Tips

- Widely recommended by international diabetes and cardiovascular medical associations²³



The Results

The DASH diet has been studied in nearly 950,000 individuals (intervention durations ranging from 3.5 to 16 years) and is associated with:²³

- Decreased incidence of cardiovascular disease, coronary heart disease, stroke, and diabetes
- Lower systolic and diastolic blood pressure, total cholesterol, LDL-c, A1c, and fasting insulin

PATTERN-BASED EATING PATTERNS

Sun	Mon	Tue	Wed	Thu	Fri	Sa

Fish and poultry should be eaten twice per week, while red meat should be limited to a few times per month.

**REPLACE
 BUTTER WITH
 HEALTHY
 OILS**



**USE HERBS
 AND SPICES IN
 PLACE OF SALT**

Mediterranean Diet

Get Started²⁵

- Plant-based foods, such as fruits and vegetables, whole grains, legumes, and nuts
- Fish and poultry twice per week
- Red meat limited to a few times per month
- Low-fat dairy preferred
- Replace butter with healthy oils
- Use herbs and spices in place of salt



Tips

- While evidence for weight loss with the Mediterranean diet is not strong, it is encouraged by major scientific organizations for prevention of major chronic diseases²³

The Results

The PREDIMED study assigned more than 7,000 individuals who had type 2 diabetes, or at least three risk factors for cardiovascular disease, to either a Mediterranean diet supplemented with extra-virgin olive oil, a Mediterranean diet supplemented with mixed nuts, or a control diet where individuals were advised to reduce dietary fat.²⁶ The study reported the following in the Mediterranean diet groups:

- Statistically significant 30% reduction in cardiovascular events
- 40% reduction in the risk of developing type 2 diabetes

A systematic review and meta-analysis (intervention duration 12 weeks to 6 years) of individuals with chronic diseases following a Mediterranean diet reported:²⁷

- Improvements in body weight, waist circumference, systolic and diastolic blood pressure, HOMA-IR index, blood glucose, triglycerides, total cholesterol and HDL-c

Finally, a large meta-analysis including more than 1.5 million **healthy** adults showed:²⁸

- Statistically significant reduced risk of cardiovascular and all-cause mortality

Hungry for More

Considered a heart-healthy eating plan, the Mediterranean diet focuses on plant-based foods typical in Mediterranean-style cooking.²⁵ Approximately 25-30% of energy is from monounsaturated fats.¹⁰

PATTERN-BASED EATING PLANS

The Paleo diet **eliminates**



Paleo Diet



Get Started²⁹

- Includes fruits, vegetables, nuts and seeds, lean meats from grass-fed animals or wild game, fish, and oils from fruits and nuts
- Eliminates grains, legumes, dairy, sugar or sweeteners other than honey, salt, potatoes, and processed foods



Tips

- May be low in calcium, fiber, and other vitamins¹⁰



The Results

The paleo diet is not well studied but has been associated with:

- Short- (6 months) and long-term (24 months) weight loss¹⁵
- Improvements in triglycerides, systolic and diastolic blood pressure, HDL-c, and fasting blood glucose³⁰

Hungry for More

The Paleolithic, or “Paleo” diet, was based on the theory that eating like our Paleolithic ancestors could provide health benefits for modern humans.³¹ It includes foods that are similar to those that were hunted and gathered prior to the emergence of farming.²⁹

Plant-based



Get Started³²

- Vegan or strict vegetarian diets—contains no animal products
- Lacto-vegetarian—includes dairy
- Lacto-ovo-vegetarian diets—includes eggs and dairy
- Pesco-vegetarian—includes fish and shellfish
- Semi-vegetarian—relatively standard diets that limit red meats and poultry



Tips³²

- Data not available in a significantly diverse population or for substantial periods of time
- Increased risk of deficiencies in B12, iron, zinc, calcium, vitamin D, and omega-3 fatty acids among vegans



The Results

A systematic review and meta-analysis of 15 (intervention duration from 12 weeks to 2 years) trials that included a vegetarian diet for at least four weeks but did not restrict energy intake found a significant reduction in weight.³³



**vegan or strict
 vegetarian diets**



lacto-vegetarian



lacto-ovo-vegetarian



pesco-vegetarian



semi-vegetarian

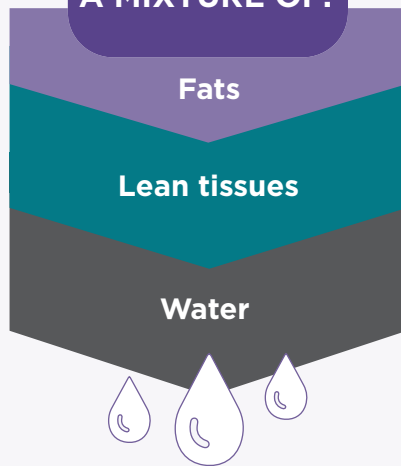
Hungry for More

Plant-based diets are becoming more popular both for perceived health benefits and for humane reasons.

At a Glance

PATTERN-BASED EATING PATTERNS			
EATING PLAN	DESCRIPTION	BENEFITS	CONSIDERATIONS
DASH	<ul style="list-style-type: none"> • Vegetables, fruits, whole grains, low- or fat-free dairy, fish, poultry, beans, nuts, and vegetable oils according to energy needs • Limit saturated fats, tropical oils, sugar-sweetened beverages and sweets • Sodium limit of 2,300 mg daily²² 	<ul style="list-style-type: none"> ↓ incidence of cardiovascular disease, coronary heart disease, stroke ↓ blood pressure, LDL-c, A1c, fasting insulin²³ 	Widely recommend by international diabetes and cardiovascular medical associations ²³
Mediterranean	Fish and poultry 2x/wk, red meat limited to a few times/month, low-fat dairy preferred, red wine in moderation ²⁵	<ul style="list-style-type: none"> ↓ body weight, waist circumference, blood pressure, HOMA-IR index, blood glucose, triglycerides ↑ HDL-c, cholesterol^{26,27} 	Approximately 25-30% of energy from monounsaturated fat ¹⁰
Paleo	<ul style="list-style-type: none"> • Includes foods historically hunted and gathered (eg, vegetables, fruits, seeds, meat, fish) • Eliminates grains, legumes, dairy, sugar, and sweeteners²⁹ 	↓ short- and long-term weight ³⁸⁻⁴⁰	↓ calcium, fiber, vitamins ¹⁰
Plant-based	Several types, including vegan (no animal products), lacto-vegetarian (includes dairy), lacto-ovo-vegetarian (includes dairy, eggs), pesco-vegetarian (includes fish, shellfish), semi-vegetarian (limits red meat, poultry) ³²	↓ weight, body mass index ³³	Data not available in diverse populations or for substantial periods of time ³² Vegan: ↓ B12, iron, zinc, calcium, vitamin D, omega-3 fatty acids ³²

WEIGHT LOSS
IS TYPICALLY
A MIXTURE OF:



Calorie-restricted Approaches

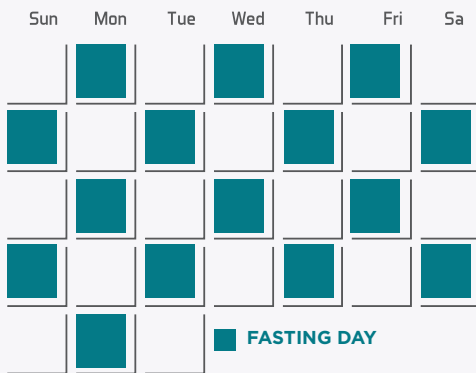
Calorie restriction approaches rely on basic physics and biochemistry—if an individual ingests fewer calories than they use, the calorie deficit must be provided by the body itself. This is an oversimplification, however, as weight loss is typically a mixture of fat, lean tissues, and water, and it is difficult to predict the amount of weight reduction from a given calorie deficit. Also, the body resists using its fat stores, and therefore it can and will adjust how it operates to avoid starvation through means such as lowering basal metabolism. **To avoid a starvation response, many calorie-restricted-based approaches suggest between 1,200-1,800 calories/day**, based on sex, age, and activity level, among other factors.¹⁰ Many commercial weight loss programs provide food lists or prepackaged foods, recommend exercise, encourage food diaries, and provide weight loss or maintenance support plans. While weight loss has been demonstrated on these plans, there is no one plan that results in clinically meaningful differences over the others.³⁴ When discussing these eating plans with individuals, it is important to acknowledge that the long-term effects of these diets on weight and risk of chronic disease have not been established.¹⁰



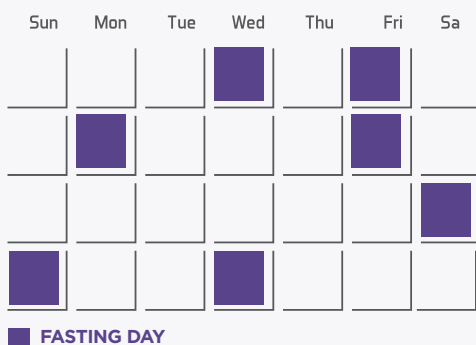
To avoid starvation response, most calorie restriction approaches suggest between 1,200-1,800 calories/day

CALORIE-RESTRICTED APPROACHES

Alternate days:



Whole days:



Time restricted:



Intermittent Fasting



Get Started

One of three approaches is typically used:³⁵

- Alternate days: Alternating normal eating and fasting days; fasting days include one meal consisting of 25% of the individual's calorie needs for that day
- Whole days: One to two days of complete fasting per week, with normal eating on the remaining days
- Time-restricted: Fasting during a certain window of time every day and normal eating for the remainder of the day (eg, fast for 16 hours with 8 hours of eating time)



Tips

- Practicality is questionable—many find it difficult to adjust their routines to accommodate the restricted eating schedule, and dropout rates are as high as 65%³⁵



The Results

A review of 40 studies across alternate-day fasting experiments found:³⁵

- Body weight reduction
- Decrease in fat mass
- May improve risk factors associated with cardiovascular disease

Whole-day fasting demonstrates:³⁵

- Decreases in body weight and fat
- No significant differences between whole- and alternate-day fasting when total caloric input is equivalent

While time-restricted fasting is not as well researched, one study found:³⁵

- Reductions in weight and fat mass
- Mixed results for markers of cardiovascular health

Hungry for More

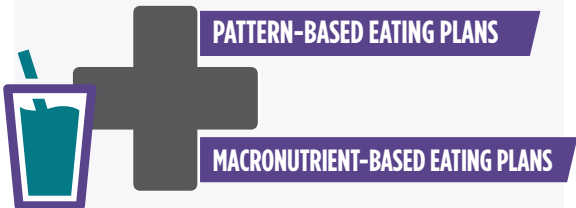
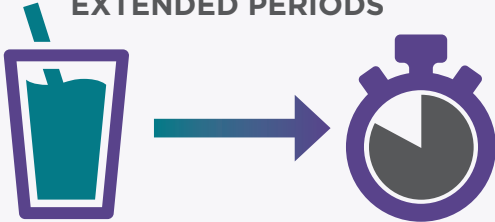
Intermittent fasting-based approaches attempt to utilize short fasting periods to improve overall health and decrease body fat and/or increase muscle mass.³⁵ Many fasting-based approaches require total abstinence of caloric intake, while others allow some food consumption. These methods intend to cause utilization of an individual's fat stores while sparing catabolism of lean mass. The data suggest that adding a small meal equaling roughly 25% of the daily caloric needs to the fasting period may help preserve lean mass without sacrificing reduction in fat mass.³⁵

CALORIE-RESTRICTED APPROACHES



**CAN BE USED FOR
 WEIGHT CONTROL**

**CAN BE SOLE SOURCE
 OF NUTRITION FOR
 EXTENDED PERIODS**



Snack and Meal Replacement



Get Started³⁶

- Widely available to consumers
- Can be used for weight control
- Some can be sole source of nutrition for extended periods, and many are partial meal replacements (PMR)
- Can be used in combination with any other eating plan
- Include specialized products for populations such as the malnourished, the hospitalized elderly, individuals with diabetes, and individuals with other chronic medical conditions



Tips¹⁰

- There are a broad variety of specialized products for specific populations, such as those with type 2 diabetes³⁶⁻³⁷



The Results

The efficacy of long-term weight management using meal replacement approaches has been evaluated in a meta-analysis of six studies.³⁸ The analysis found:

- Significant weight loss on either PMR plan or reduced-calorie diet at both 3-month and 1-year time points
- PMR plan associated with significantly more weight loss than reduced-calorie diet
- Risk factors for diseases associated with overweight and obesity improved in both groups

The LOOK AHEAD study randomized more than 5,000 individuals with overweight or obesity and type 2 diabetes to a 1,000 kcal diet and 4 servings/day of liquid meal replacement, a 1,200-1,500 kcal/day balanced deficit diet, or a nondieting approach.³⁹ The study found:

- Those in the highest quartile for number of meal replacements were four times more likely to reach 10% weight reduction compared to those in the lowest quartile³⁹
- 93% of individuals lost more than 10% of their body weight in the first year⁴⁰
- Nearly 40% maintained weight reduction at Year 8⁴⁰

At a Glance

CALORIE-RESTRICTED APPROACHES

EATING PLAN	DESCRIPTION	BENEFITS	CONSIDERATIONS
Commercial Weight Loss Programs	Calories restricted to approximately 1,200 to 1,800 calories per day based on energy needs ¹³	↓ weight on commercial plans, but no clinically meaningful differences among plans ⁴⁵	Long-term effects on weight and chronic disease not established ¹³
Intermittent Fasting	Short fasting periods that can occur on alternate days with 1 small meal (~25% calorie needs), 1 to 2 whole days/week, or time-restricted during a certain window every day ³⁵	↓ body weight, fat mass, mixed cardiovascular results ³⁵	Practicality questionable—dropout rates as high as 65% ³⁵
Snack and Meal Replacement Approaches	Specialized food and beverages for populations such as malnourished and individuals with diabetes or other chronic medical conditions ³⁶	↓ short- and long-term weight ³⁸⁻⁴⁰	Use options that are low in sugar ³⁷

WHICH EATING PLAN IS BEST? WHAT DO THE DATA SUGGEST?

Numerous studies have tried to ascertain the best eating plan; however, the data clearly show that there is no one-size-fits-all eating pattern.^{20,41-43}

Many factors, including genetics and individual insulin dynamics, play a part in an individual's biochemical response to any given diet.⁴¹ However, certain populations may have better results with particular eating plans. For example, individuals with insulin resistance may have better results with a lower carbohydrate diet, while those who are insulin sensitive may have better results with a lower fat diet.⁴⁴ Furthermore, in individuals with cardiovascular risks, it may be important to consider that a low-carbohydrate diet may result in increases in total cholesterol,⁴⁵⁻⁴⁷ but is also associated with greater increases in HDL-c⁴⁵⁻⁴⁷ and short-term reductions in triglycerides compared to a low-fat diet.^{48,49} It is also important to note that there are no long-term safety data on low-carbohydrate diets, so it is difficult to know if the positive effects of the diet (eg, weight loss, reduced triglycerides) outweigh potential adverse effects (eg, increased total cholesterol, low dietary fiber intake effects).⁴⁶

In summary, nearly any nutrition program that an individual chooses that is focused on healthy eating and reduces dietary energy intake will result in weight loss, regardless of the macronutrient distribution.^{20,50,51} **In fact, it is following an eating plan and visits with a healthcare professional that are significantly associated with reaching weight reduction goals.**^{20,39,43}

Healthcare professionals must tailor nutrition counseling to an individual's preferences and clinical needs, with the understanding that the ability of an individual to follow a diet plan, as opposed to the specifics of the plan itself, is one of the most important factors for success. Healthcare professionals can assist patients with motivational interviewing and brief counseling interventions. In addition, a person-centered approach is essential to support behavior change, improve outcomes, and reduce risks. Remember that adults who are simply given advice by their healthcare professional are more likely to change their eating habits,⁵² and small shifts in food choices can make a difference."³

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