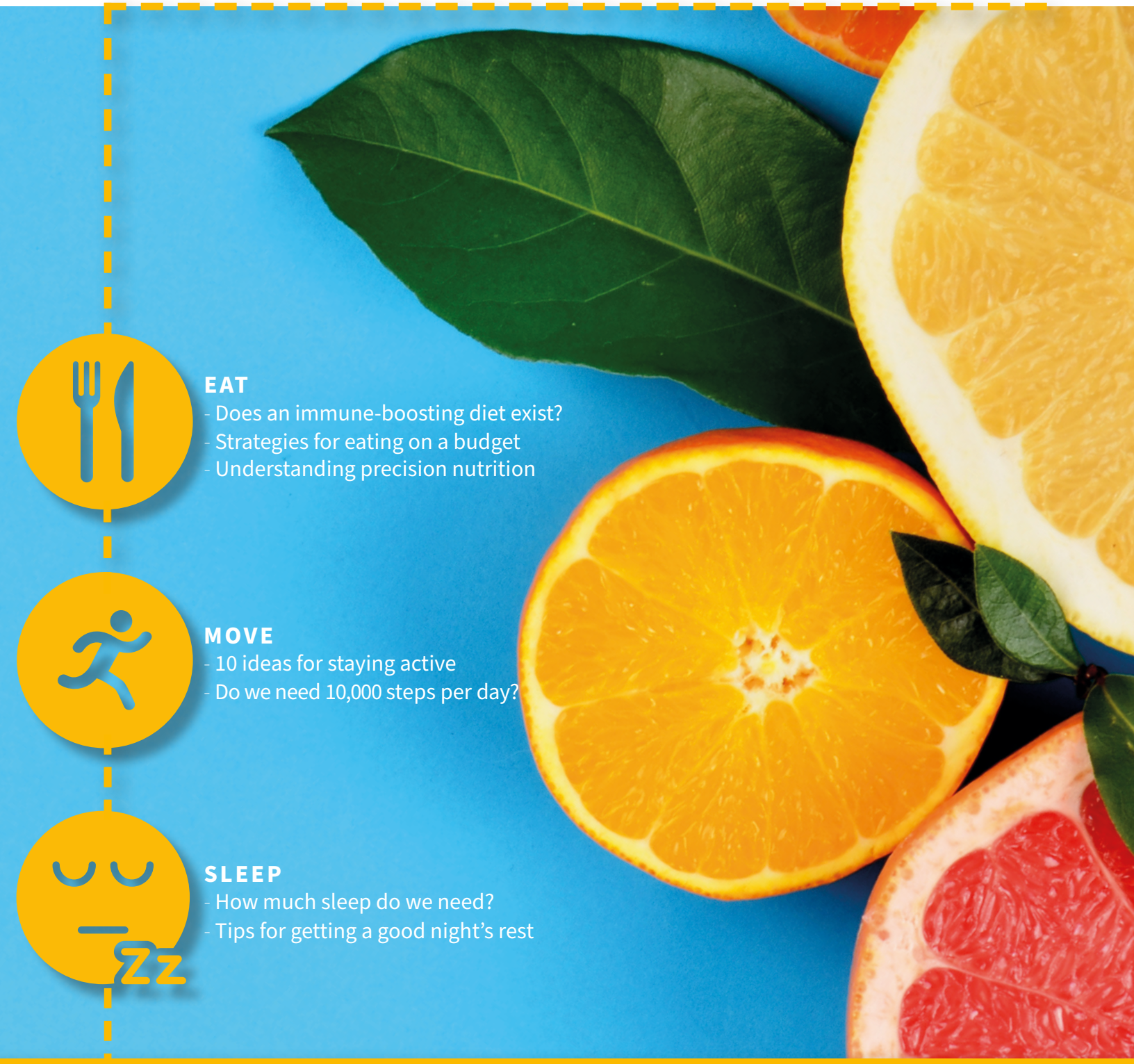
Healthy Living Guide 2020 /2021

A DIGEST ON HEALTHY EATING AND HEALTHY LIVING

From the Department of Nutrition at the Harvard T.H. Chan School of Public Health



EAT

- Does an immune-boosting diet exist?
- Strategies for eating on a budget
- Understanding precision nutrition

MOVE

- 10 ideas for staying active
- Do we need 10,000 steps per day?

SLEEP

- How much sleep do we need?
- Tips for getting a good night's rest

PLUS

Understanding the impacts of stress on eating patterns and health, and strategies that may help control it.

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Navigating Health During COVID-19 and Beyond

As we transition from 2020 into 2021, the COVID-19 pandemic continues to affect nearly every aspect of our lives. For many, this health crisis has created a range of unique and individual impacts—including food access issues, income disruptions, and emotional distress.

Although we do not have concrete evidence regarding specific dietary factors that can reduce risk of COVID-19, we do know that maintaining a healthy lifestyle is critical to keeping our immune system strong. Beyond immunity, research has shown that individuals following five key habits—eating a healthy diet, exercising regularly, keeping a healthy body weight, not drinking too much alcohol, and not smoking—live more than a decade longer than those who don't. Plus, maintaining these practices may not only help us live longer, but also better. Adults following these five key habits at middle-age were found to live more years free of chronic diseases including type 2 diabetes, cardiovascular disease, and cancer.

While sticking to healthy habits is often easier said than done, we created this guide with the goal of providing some tips and strategies that may help. During these particularly uncertain times, we invite you to do what you can to maintain a healthy lifestyle, and hopefully (if you're able to try out a new recipe or exercise, or pick up a fulfilling hobby) find some enjoyment along the way.

Learn more about food safety, nutrition, and wellness during the COVID-19 pandemic: ***hsph.me/fsn20***

click on the link

scan QR code with smartphone camera

ACCESS ADDITIONAL CONTENT

Throughout the guide you will find these callouts to related content on *The Nutrition Source* website. If you're already reading digitally, simply click the hyperlink. If you have a printed copy, point your smartphone's camera at the QR code until the prompt appears to access the webpage.

Nutrition and Immunity

During the flu season or times of illness, people often seek specific foods or vitamin supplements that are believed to boost immunity. Vitamin C and foods like citrus fruits, chicken soup, and tea with honey are popular examples. Yet the design of our immune system is complex and influenced by an ideal balance of many factors.

WHAT IS OUR IMMUNE SYSTEM?

On a daily basis, we are constantly exposed to potentially harmful microbes of all sorts. Our immune system, a network of intricate stages and pathways in the body, protects us against these harmful microbes as well as certain diseases. It recognizes foreign invaders like bacteria, viruses, and parasites and takes immediate action. Humans possess two types of immunity: ***innate immunity*** (protective barriers such as our skin, mucus, stomach acid, enzymes, and immune system cells) and ***adaptive or acquired immunity*** (a system that learns to recognize and attack a pathogen that enters our body).

However, a range of factors can depress the immune system, such as environmental toxins (e.g. smoke and other particles contributing to air pollution), certain diseases (e.g. autoimmune and immunodeficiency disorders), excess weight, chronic stress, lack of sleep, and poor diet.

Learn more about the complexities of the immune system, and conditions that trigger an immune response: ***hsph.me/nim20***

DOES AN IMMUNE-BOOSTING DIET EXIST?

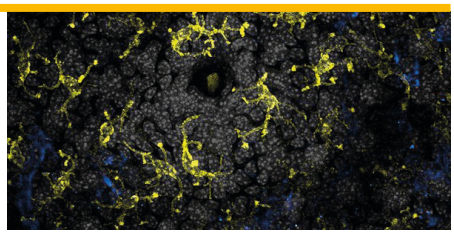
Eating enough nutrients as part of a varied diet is required for the health and function of all cells, including immune cells. Certain dietary patterns may better prepare the body for microbial attacks and excess inflammation, but it is unlikely that individual foods offer special protection. Each stage of the body's immune response relies on the presence of many micronutrients. Examples of nutrients that have been identified as critical for the growth and function of immune cells include vitamin C, vitamin D, zinc, selenium, iron, and protein (including the amino acid glutamine).[1,2] They are found in a variety of plant and animal foods.

Diets that are limited in variety and lower in essential nutrients, such as vitamins and minerals, can negatively affect a healthy immune system. There is growing evidence that a Western diet high in refined sugar and red meat and low in fruits and vegetables can promote disturbances in healthy intestinal microorganisms, resulting in chronic inflammation of the gut, and associated suppressed immunity.[3]

The microbiome is an internal metropolis of trillions of microorganisms or microbes that live in our bodies, mostly in the intestines. It is

an area of intense and active research, as scientists are finding that the microbiome plays a key role in immune function. The gut is a major site of immune activity and the production of antimicrobial proteins.[4,5] Our diets play a large role in determining what kinds of microbes live in our intestines. A high-fiber plant-rich diet with plenty of fruits, vegetables, legumes, and whole grains appears to support the growth and maintenance of beneficial microbes. Certain helpful microbes break down fibers into short chain fatty acids, which have been shown to stimulate immune cell activity. These fibers are sometimes called prebiotics because they feed microbes. Therefore, a diet containing probiotic and prebiotic foods may be beneficial. Probiotic foods contain live helpful bacteria, and prebiotic foods contain fiber and oligosaccharides that feed and maintain healthy colonies of those bacteria.

- **Probiotic foods** include kefir, yogurt with live active cultures, fermented vegetables, sauerkraut, tempeh, kombucha tea, kimchi, and miso.
- **Prebiotic foods** include garlic, onions, leeks, asparagus, Jerusalem artichokes, dandelion greens, less-ripe bananas, and seaweed. However, a more general rule is to eat a variety of fruits, vegetables, legumes (such as beans, peas, lentils), and whole grains for dietary prebiotics.



Learn more about the microbiome:
hsph.me/ome20

DO VITAMIN OR HERBAL SUPPLEMENTS HELP?

A deficiency of just a single nutrient can alter the body's immune response. Animal studies have found that deficiencies in zinc, selenium, iron, copper, folic acid, and vitamins A, B6, C, D, and E can alter immune responses.[6] These nutrients help the immune system in several ways: working as an antioxidant to protect healthy cells, supporting growth and activity of immune cells, and producing antibodies. Epidemiological studies find that those who are poorly nourished are at greater risk of bacterial, viral, and other infections.

Eating a good quality diet can prevent deficiencies in these nutrients. However, there are certain situations in which one cannot always eat a variety of nutritious foods, and certain populations that have increased nutrient needs. In these cases a vitamin and mineral supplement may help to fill nutritional gaps. These supplements are relatively inexpensive, typically costing less than 10 cents per day. Studies have shown that vitamin supplementation can improve immune responses in these populations.[6-8] Low-income households, pregnant and lactating women, infants and toddlers, and the critically ill are examples of groups at risk.

The elderly are a particularly high-risk group. The immune response generally declines with increasing age as the number and quality of immune cells decreases. This causes a higher risk of poorer outcomes if the elderly develop chronic or acute diseases. In addition, about one-third of elderly individuals in industrialized countries have nutrient deficiencies.[6] Some reasons include a poorer appetite due to chronic diseases, depression, or loneliness; multiple

Several supplements derived from herbs and other plants have been suggested to boost immune function. But what does the research say?

ECHINACEA

Cell studies have shown that echinacea can destroy influenza viruses, but limited research in humans has been inconclusive in determining echinacea's active components. Taking echinacea after catching a cold has not been shown to shorten its duration, but taking it while healthy may offer a small chance of protection from catching a cold.[9,10]

GARLIC

The active ingredient in garlic, allicin sativum, is proposed to have antiviral and antimicrobial effects on the common cold, but high-quality trials comparing garlic supplements to placebo are lacking. A Cochrane review identified only one trial of reasonable quality following 146 participants. Those taking the garlic supplement for 3 months had fewer occurrences of the common cold than those taking a placebo, but after contracting the cold virus, both groups had a similar duration of illness.[11] Note that these findings are from a single trial, which needs to be replicated.

TEA CATECHINS

Cell studies have shown that tea catechins such as those found in green tea can prevent replication of flu and some cold viruses, and can increase immune activity. Human trials are still limited. Two randomized controlled trials found that green tea capsules produced less cold/flu symptoms or incidence of flu than a placebo; however both studies were funded or had author affiliations with tea industries.[12]

medications that can interfere with nutrient absorption and appetite; malabsorption due to intestinal issues; and increased nutrient needs due to hypermetabolic states with acute or chronic conditions. Diet variety may also be limited due to budget constraints or lower interest in cooking for one person; poor dentition (e.g. missing teeth, ill-fitting dentures); mental impairment; or lack of transportation and resources to obtain healthy food.

A general multivitamin/mineral supplement providing the recommended dietary allowances (RDA) may be used in these cases, unless otherwise directed by one's physician. Megadose supplements (many times the RDA) do not appear justified, and can sometimes be harmful or even suppress the immune system (e.g. as with zinc). Remember that supplements are not a substitute for a good diet because no supplements contain all the benefits of healthful foods.

Related

Vitamin D's role in regulating the immune system has led to considerable research in this area. Learn more about vitamin D and health: **hsph.me/vd20**

From "Ask the Expert: The role of diet and nutritional supplements during COVID-19" **hsph.me/aco20**

8 Tips to help support a Healthy Immune System

Eat a healthy and balanced diet. *Use the Healthy Eating Plate as a guide.*

If a balanced diet is not readily accessible, ***consider taking a multivitamin*** *containing the RDA for several nutrients.*

Don't smoke *(or stop smoking if you do).*

Limit ***alcohol****.*

Perform moderate ***regular exercise****.*

Aim for 7-9 hours of ***sleep*** *every night.*

Although easier said than done, aim to ***manage stress****.*

Wash your hands *throughout the day.*

> *We have known for a long time that nutrition is intricately linked to immunity and to the risk and severity of infections. Poorly nourished individuals are at a greater risk of various bacterial, viral, and other infections. Conversely, chronic or severe infections lead to nutritional disorders or worsen the nutritional status of affected people. Therefore, it is imperative for all of us to pay attention to our diet and nutritional status during the ongoing COVID-19 pandemic.*
>
> **- Dr. Wafaie Fawzi, Dr. Walter Willett, and Dr. Ibraheem Abioye**

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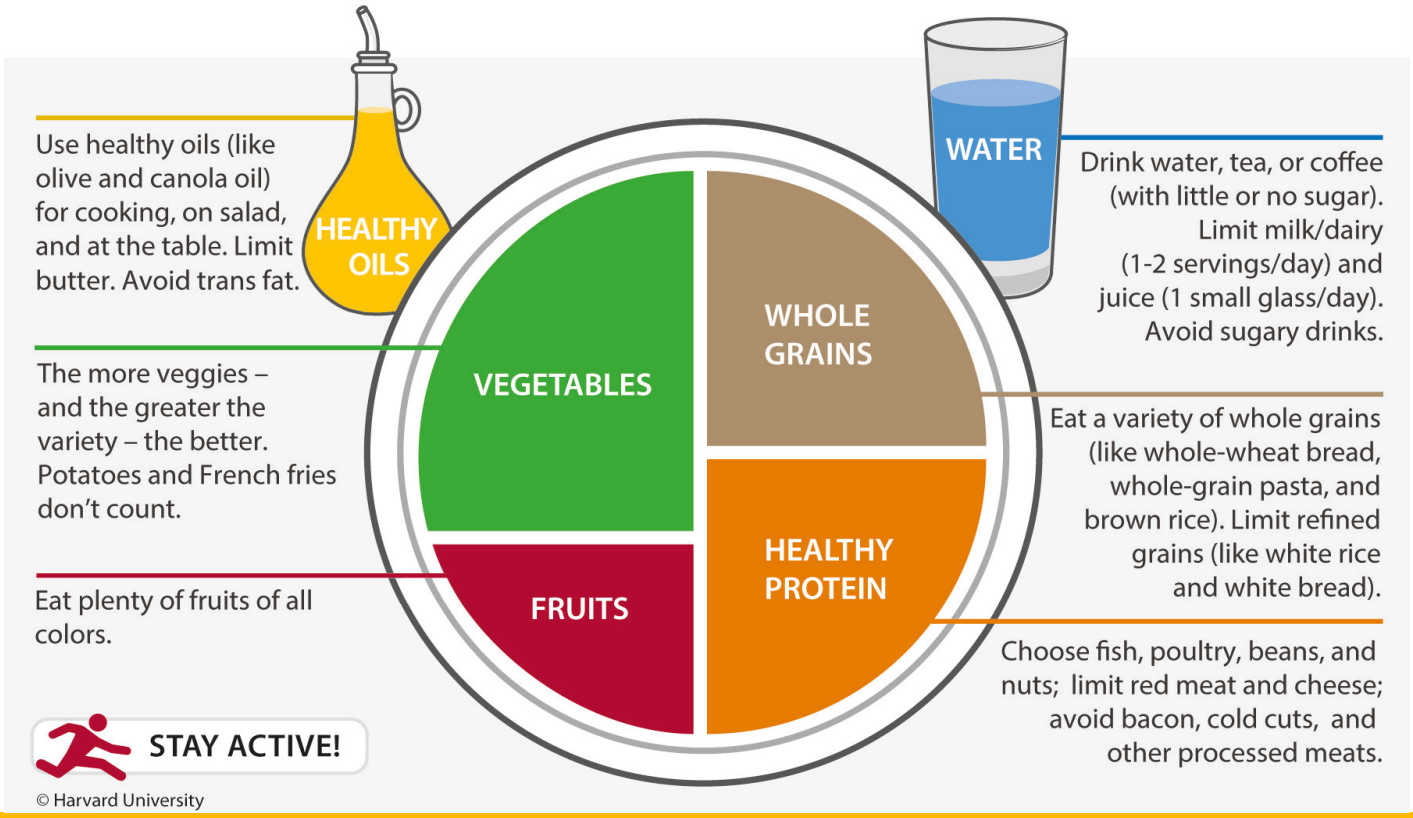
HEALTHY EATING PLATE



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Build a Healthy Meal

Eating a variety of foods keeps our meals interesting and flavorful. It's also the key to a balanced diet because each food has a unique mix of nutrients. At a glance, the Healthy Eating Plate and Kid's Healthy Eating Plate provide a blueprint to creating healthy meals—whether served at the table or packed in a lunch box.

Learn more about these resources and access other downloadable tools, including a Kid's Plate coloring page, and over 25 translations of the Healthy Eating Plate: ***hsph.me/hep20***

Lentils

Lentils are one of the earliest domesticated crops, seen in the diets of ancient Rome and Egypt. Learn about this staple legume.

Lentils receive their scientific name, *Lens culinaris*, from their curved lens-shaped seed. They are a type of legume that is native to Western Asia and North America. Canada leads the world's production of lentils, followed by India. Common types of lentils available in the U.S. are green, brown, black, red, yellow, and orange. Many countries enjoy lentils as a dietary staple, as they offer an earthy, mild, nutty flavor that works well in various recipes.

More on lentils and health, and tips for cooking with this versatile legume: ***hsph.me/len20***

Lentils are naturally low in sodium and saturated fat, and high in potassium, fiber, folate, and plant chemicals called polyphenols. These nutritional properties have led researchers to study their effects on chronic diseases. Lentils also contain resistant starch that is digested more slowly and therefore prevents surges in blood sugar. Additionally this resistant starch is a prebiotic that feeds gut flora to help prevent digestive diseases. Studies have shown that lentils can lower blood pressure, blood cholesterol, and blood glucose. Additional research has found that lentils may improve cardiovascular risk factors in people with diabetes and may lower the risk of breast cancer in women.

***FRENCH STYLE LENTILS**: This is a simple, hearty dish that's a great introduction to this versatile legume—and a perfect way to stay warm on those cold winter nights. You can use black (Beluga) lentils, brown lentils, green lentils, or French lentils for this recipe. Do not use red lentils or lentils with their hulls removed.*

INGREDIENTS

- 1 cup lentils, rinsed and picked over
- 4 cups water
- 1 carrot, peeled, halved lengthwise, cut into 4 pieces
- 1 garlic clove, smashed lightly
- 2 bay leaves
- Salt and pepper
- 3 Tbsp. extra-virgin olive oil
- 1 shallot, chopped fine
- 2 Tbsp. sherry wine or dry white wine
- 3/4 cup low-sodium vegetable broth
- 2 tsp. whole grain mustard
- 2 tsp. red wine vinegar
- 1/2 cup Greek yogurt
- 2 Tbsp. minced chives

SERVES: 4

PREPARATION

1. Bring lentils, water, carrots, garlic, bay leaves, and 1 teaspoon salt in 12-inch skillet to simmer over medium-high heat. Reduce heat to low and simmer uncovered, skimming any foam off top as it rises to surface, until lentils are just cooked through and have slight bite, 20 to 25 minutes. Drain lentils in colander set over large bowl, reserving carrots; discard garlic and bay leaves. Chop carrots into 1/4-inch pieces and set aside. Wipe skillet clean. Run cold water over lentils until water runs clear, about 3 changes of water. Drain lentils and set aside.
2. Heat 1 tablespoon oil in now-empty skillet over medium heat until shimmering. Stir in shallots and ½ teaspoon salt and cook, stirring occasionally, until softened but not browned, about 2 minutes. Stir in wine and cook until liquid has nearly evaporated, about 30 seconds. Stir in broth and remaining 2 tablespoons oil, bring mixture to simmer, and cook, swirling pan occasionally, until mixture is smooth and combined, about 30 seconds. Stir in lentils and reserved carrots and cook, stirring occasionally, until lentils are heated through and well coated, about 2 minutes longer. Off heat, stir in mustard and vinegar. Season with salt and pepper to taste. Sprinkle with chives and serve, adding extra mustard and vinegar if desired.

Recipe courtesy of Tim Chin

FOR YOUR HEALTH AND THE PLANET'S HEALTH

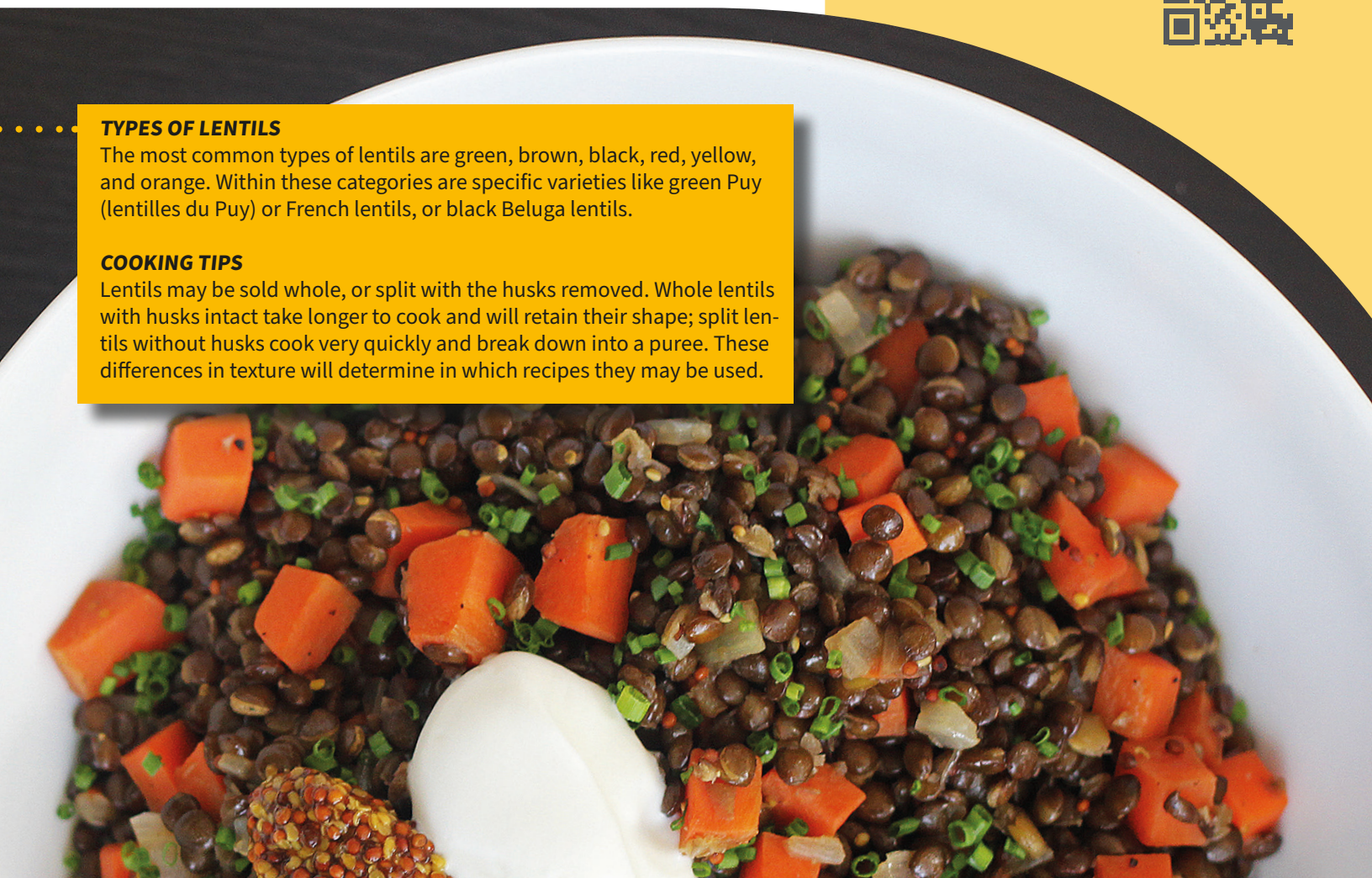
Along with varying impacts on human health, different foods also have differing impacts on the environment. The production of plant-based foods tends to have lower greenhouse gas emissions, and use less land and water than the production of animal-based foods. In transitioning towards healthy diets from sustainable food systems —especially with an expected global population of 10 billion by 2050—legumes (such as lentils, peas, beans, and peanuts) are slated to play a key role. The 2019 EAT-*Lancet* report that outlines a "planetary health diet" recommends 50 grams of legumes (with a range of up to 100 grams) daily.

Legumes have a range of characteristics that make them a relatively sustainable crop. For example, legumes release up to seven times less greenhouse gas emissions per area compared to other crops, and can sequester carbon in soils. They can also make their own nitrogen from the atmosphere, thus reducing the application of nitrogen fertilizers. This leaves nitrogen-rich residues in the soil after harvesting; a benefit for the next crop planted in its place. According to the Food and Agriculture Organization of the United Nations, drought-resistant species of legumes can be of particular benefit to dry environments where food security is often a challenge. They can also help minimize food waste, since legumes can be dried and stored for long periods of time without losing their nutritional value.

Can plant-based meat alternatives be part of a healthy and sustainable diet?

A new wave of plant-based meat alternatives has emerged, designed to recreate the taste and experience of eating meat. Marketed as a way to accelerate the shift from industrial animal agriculture, popular products from brands like Impossible Foods and Beyond Meat have garnered significant consumer interest. Although these products are likely to have less environmental impact than their red meat counterparts, further studies are warranted to assess their effects on human health. For now, the bottom line is that although they are considered healthier alternatives to red meat, these novel products are not a substitute for minimally processed plant-based foods and eating patterns.

Ask the Expert: Plant-based meat alternatives
hsph.me/pbm20



TYPES OF LENTILS

The most common types of lentils are green, brown, black, red, yellow, and orange. Within these categories are specific varieties like green Puy (lentilles du Puy) or French lentils, or black Beluga lentils.

COOKING TIPS

Lentils may be sold whole, or split with the husks removed. Whole lentils with husks intact take longer to cook and will retain their shape; split lentils without husks cook very quickly and break down into a puree. These differences in texture will determine in which recipes they may be used.

Eating Well on a Budget

From the supermarket to the kitchen, here are some strategies to get the biggest nutrition bang for your buck.

An all-too-common mantra says, "It's too expensive to eat healthy." It's true that when comparing specific foods like organic fruits with conventional fruits, the former tends to be a few dollars more per pound. And when a shopping cart filled with fresh produce, poultry, and fish is compared to one loaded with boxes of macaroni and cheese, ground hamburger, and cookies, the latter will likely ring lower at the cash register.

Certainly, policy improvements and other actions are needed to create a food environment where the healthy choice is the easy and accessible choice. In the meantime, know that creating nutritious meals can be more affordable than one might think.

A NOTE ON FOOD AFFORDABILITY

If you (or someone you know) are struggling with food access, there are several options to help. Along with a nationwide network of food pantries, the U.S. federal government offers food assistance programs for citizens and legal noncitizens whose income meets certain guidelines and/or who have certain nutritional needs.

Learn more about navigating these resources: ***hsph.me/sup20***

Shop your pantry first. Commit to taking inventory of all the food in your kitchen twice a month. Bring forward the buried items and use what you have before buying more.

Consider meatless meals. Plant-based proteins are nutritious and generally more affordable than meats and fish. If you still crave meat, incorporate smaller amounts, while focusing on plant proteins like canned beans or tofu so that you can save on cost, increase volume of the meal, and boost nutrition and heartiness.

Don't shop on an empty stomach. Munch on a piece of fruit or some nuts before entering the store.

Purchase foods and snacks that are satiating and filling. How easy is it to eat a half a package of chips in one sitting? In contrast, how many apples or handfuls of nuts can you eat at one time? Even though a 3-pound bag of apples may cost $4.00 versus $2.50 for a large bag of chips, consider which will satisfy your hunger longer.

Scan the discounted produce cart that usually sits in a corner. This cart is filled with fruits and veggies starting to age but still tasty if you can eat them the same day or the next day.

Shop with a list, but allow for flexibility if items like fresh produce or poultry and fish are on sale. If they are foods you enjoy, you might purchase extra quantities and freeze them for later use. Fresh meats, fish, and some produce (bananas, berries, avocados, broccoli, cauliflower, Brussels sprouts) generally freeze well. Be sure to label and date the bags or containers before placing in the freezer!

Plan out a few meals you want to prepare the next week and create your shopping list based on those ingredients. Although it takes a bit more effort up front, meal prep can ultimately help save time and money, as well as reduce the stress that comes with last-minute decisions about what to eat. Some quick tips to get you started:

- Discuss with your family what types of foods and favorite meals they like to eat.
- Start a monthly calendar or spreadsheet to record your meal ideas, favorite recipe sites, and food shopping lists.
- Consider specific meals or foods for different days of the week: Stir-Fry Mondays, Fish Fridays, etc.

Access the full meal prep guide along with recipes that lend well to bigger batches at ***hsph.me/pre20***

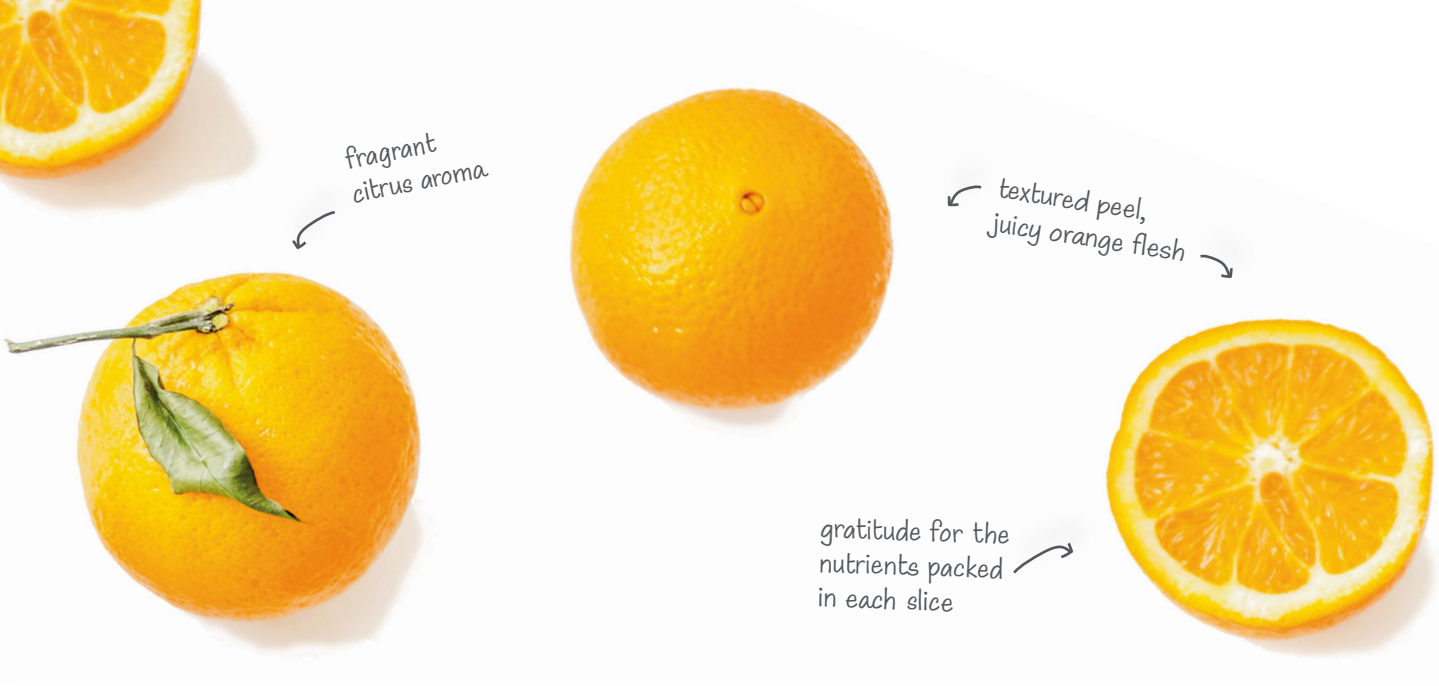
Consider purchasing nonperishable staple foods in bulk. Even though it may cost more upfront to buy "family-sized" packages of products like whole grains, lentils, and dried beans, the cost per unit is usually cheaper. To determine this, find the common unit of measurement when comparing two products. For example, a bag of brown rice may be in pounds. Divide the price by total pounds, which is the price per unit.

Buy generic or store-brand. You will notice when comparing the ingredients list that similar if not identical ingredients are used. The generic brand is generally cheaper because less money is spent on advertising and creating fancy food labels.

Stretch your fresh herbs. Unless a recipe calls for a whole package (e.g. a bunch of basil for pesto), you'll be left with extra sprigs. Careful storage can help extend the shelf life (e.g. cilantro in a cup of water covered with a bag), but if you don't plan on using within one week, consider other ways to extend their utility. One idea is to chop and freeze herbs in an ice cube tray filled with olive oil—ready to be popped in a pan to sauté vegetables.

Don't buy more highly perishable items than you can use in one week (unless you plan to freeze them), or else you run the risk of spoilage and waste. Foods with short shelf-life include some bagged salad greens, mushrooms, berries, avocados, and bananas.

Eat attentively. Practicing mindfulness during meals can increase enjoyment of the food. You may even be satisfied with smaller portions.



Mindful Eating

This approach focuses on the eating experience, body-related sensations, and thoughts and feelings about food, with heightened awareness and without judgment.

Mindful eating stems from the broader philosophy of mindfulness, a widespread, centuries-old practice used in many religions. Mindfulness is an intentional focus on one's thoughts, emotions, and physical sensations in the present moment. Mindfulness targets becoming more aware of, rather than reacting to, one's situation and choices. Eating mindfully means that you are using all of your physical and emotional senses to experience and enjoy the food choices you make. This helps to increase gratitude for food, which can improve the overall eating experience. Mindful eating encourages one to make choices that will be satisfying and nourishing to the body. However, it discourages "judging" one's eating behaviors as there are different types of eating experiences. As we become more aware of our eating habits, we may take steps towards behavior changes that will benefit ourselves and our environment.

HOW IT WORKS

Mindful eating focuses on your eating experiences, body-related sensations, and thoughts and feelings about food, with heightened awareness and without judgment. Attention is paid to the foods being chosen, internal and external physical cues, and your responses to those cues.[1] The goal is to promote a more enjoyable meal experience and understanding of the eating environment. Fung and colleagues described a mindful eating model that is guided by four aspects: what to eat, why we eat what we eat, how much to eat, and how to eat. [1]
Mindful eating:

- considers the wider spectrum of the meal: where the food came from, how it was prepared, and who prepared it
- notices internal and external cues that affect how much we eat
- notices how the food looks, tastes, smells, and feels
- acknowledges how the body feels after eating the meal
- expresses gratitude for the meal
- may use deep breathing or meditation before or after the meal
- reflects on how our food choices affect our local and global environment.

THE TAKEAWAY

Mindful eating is an approach to eating that can complement any eating pattern. Research has shown that mindful eating can lead to greater psychological wellbeing, increased pleasure when eating, and body satisfaction. Combining behavioral strategies such as mindfulness training with nutrition knowledge may lead to healthful food choices that reduce the risk of chronic diseases, promote more enjoyable meal experiences, and support a healthy body image. More research is needed to examine whether mindful eating is an effective strategy for weight management.

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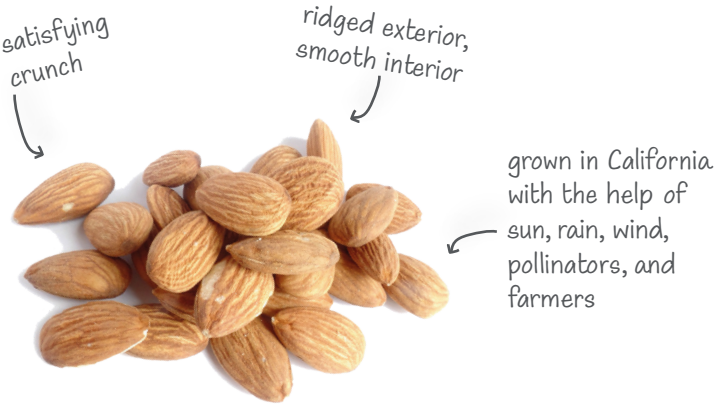
2. Hanh & Cheung, *SAVOR: Mindful Eating, Mindful Life*, 2010.

7 Practices of Mindful Eating

Adapted from *SAVOR: Mindful Eating, Mindful Life*[2]



HONOR THE FOOD

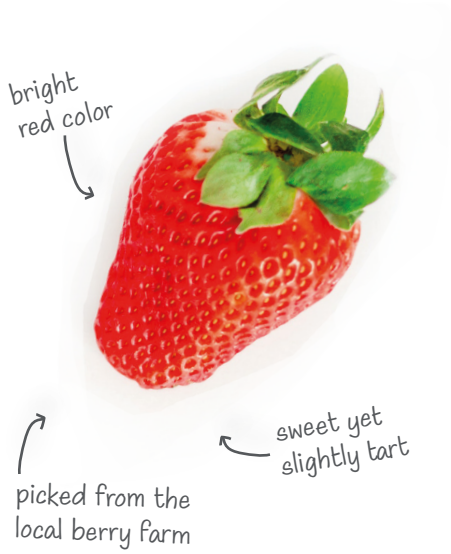
Acknowledge where the food was grown and who prepared the meal. Eat without distractions to help deepen the eating experience.

ENGAGE ALL SENSES

Notice the sounds, colors, smells, tastes, and textures of the food and how you feel when eating.

SERVE IN MODEST PORTIONS

This can help avoid overeating and food waste. Use a dinner plate no larger than 9 inches across and fill it only once.



SAVOR SMALL BITES, AND CHEW THOROUGHLY

These practices can help slow down the meal and fully experience the food's flavors.

EAT SLOWLY TO AVOID OVEREATING

If you eat slowly, you are more likely to recognize when you are feeling satisfied, or when you are about 80% full, and can stop eating.

DON'T SKIP MEALS

Going too long without eating increases the risk of strong hunger, which may lead to the quickest and easiest food choice, not always a healthful one.

EAT A PLANT-BASED DIET, FOR YOUR HEALTH AND THE PLANET'S HEALTH

Production of animal-based foods like meat and dairy takes a heavier toll on our environment than plant-based foods.

Learn about the research on mindful eating, and other tips for applying this strategy in daily life: ***hsph.me/mie20***

What is Precision Nutrition?

Separating hype from hope in this emerging research area.

Precision nutrition may sound like a new fad diet, but it is actually a credible emerging area of research supported by the National Institutes of Health under the umbrella of precision medicine.[1,2] Precision medicine seeks to improve the personalized treatment of diseases, and precision nutrition is specific to dietary intake. Both develop interventions to prevent or treat chronic diseases based on a person's unique characteristics like DNA, race, gender, health history, and lifestyle habits. Both aim to provide safer and more effective ways to prevent and treat disease by providing more accurate and targeted strategies. Precision nutrition assumes that each person may have a different response to specific foods and nutrients, so that the best diet for one individual may look very different than the best diet for another. How often are we tempted to follow a flashy diet that a celebrity or friend promoted in helping them to lose 20 pounds or "cure" their diabetes? The concept of precision nutrition would discourage this practice, as our individual blueprint might require a unique dietary plan to be successful.

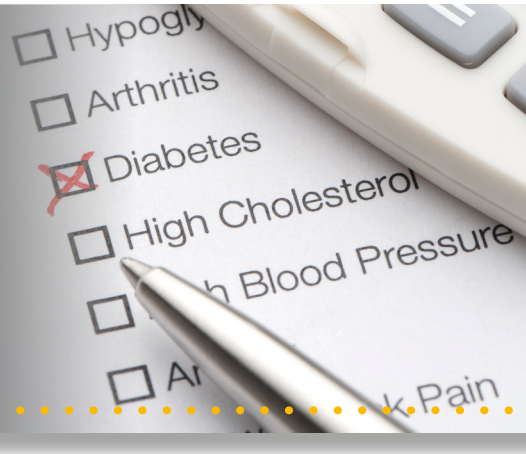
Precision nutrition also considers the microbiome, trillions of bacteria in our bodies that play a key role in various daily internal operations. What types and how much bacteria we have are unique to each individual. Our diets can determine which types of bacteria live in our digestive tracts, and according to precision nutrition the reverse is also true: the types of bacteria we house might determine how we break down certain foods and what types of foods are most beneficial for our bodies.

HOW DOES IT WORK?

Precision nutrition, also referred to as personalized nutrition, focuses on the individual rather than groups of people. Many research studies on nutrition and types of diets provide useful information for communities and the general population. High-quality nutrition studies have shown that for the average person, eating more vegetables, whole grains, and lean proteins while eating fewer highly processed foods made with added sugars and salt can help reduce the risk of various diseases. Yet, when studies such as the PREDICT 1 trial focus on individual responses to food, they have found substantial variations in blood responses of glucose and triglycerides even if individuals are eating identical meals.[3] The person's microbiome was found to cause variations in blood triglycerides after a meal. Non-food factors like sleep, physical activity, and time of meals also played a role in causing variations in blood levels of glucose and triglycerides after meals.[3] Therefore, an individual may see additional benefits if following personalized nutrition guidance beyond general health recommendations. Precision nutrition evaluates one's DNA, microbiome, and metabolic response to specific foods or dietary patterns to determine the most effective eating plan to prevent or treat disease.

PRECISION NUTRITION AND DISEASE MANAGEMENT

There are specific dietary treatments based on genetic data that have been used for years: a gluten-free diet for the management of celiac disease, a lactose-free diet for those with lactose intolerance, and the avoidance of dietary phenylalanine (an amino acid in protein foods and some artificial sweeteners) for an inherited disorder called phenylketonuria. However precision nutrition is in its early stages and too soon to introduce as a treatment for chronic diseases in the general population. Research is being conducted on the application of precision nutrition for obesity, metabolic syndrome, certain cancers, and type 2 diabetes.[4,5]



CHALLENGES AND CONSIDERATIONS

Precision nutrition is not yet ready for prime time because of various challenges—a lack of well-designed clinical trials showing consistent results, and expensive technologies needed to collect and study an individual's DNA, gut microbiome, and response to food intake.[4] Dietary interventions such as these require high-quality evidence of their effectiveness and consistency before they may be recommended for use alongside or even to replace conventional interventions for a particular disease. There may also be differences among findings in clinical trials of the individual metabolic response to a specific diet depending on the types of tests they use; this in turn could cause variation in the personalized nutrition recommendations that are provided.

Primary care physicians, registered dietitians, and other providers directly interacting with an individual need to be educated about precision nutrition, as it requires the combined joint efforts of the entire health care team. Despite individual differences in metabolic response to foods, personalized dietary advice should still align with general nutrition principles (e.g. eating more fruits and vegetables, consuming less added sugar from sugary drinks, limiting sodium, etc.). Although private companies have started to offer genetic and microbiome testing to the public to customize diets, more research needs to be done on the effectiveness and accuracy of these tests. Ethical and legal aspects of implementing precision nutrition should also be considered, including protecting consumer privacy in the use of precision nutrition technologies and tests.

It's also important to recognize that personalized approaches may be accessible to only a small segment of the population, which can widen health disparities. We must not lose sight of improving the broader food environment through effective policies, regulations, and other population-based approaches that can help make healthy food choices the default.

Learn more about precision nutrition and additional research on this emerging field: ***hsph.me/pn20***

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Popular Diets

Do they actually work for weight loss?

From bookstores to social media to blogs, there's no shortage of information on diet. So how to differentiate what "works" from an overhyped fad?

It's important to remember that even if a particular diet may be successful for one person, it may not be effective for another due to individual differences in genes and lifestyle. Diets are also more likely to be successful when they are easier to follow, so tailoring a strategy to suit your own lifestyle is key.

Still, when faced with the seemingly endless promotion of weight-loss strategies and diet plans, it helps to see what evidence is supporting them. Here, we take a look at some popular diets and approaches to eating—and review the research behind them.

Ketogenic Diet

The ketogenic or "keto" diet is a low-carbohydrate, fat-rich eating plan that has been used for centuries to treat specific medical conditions. However in recent years, this diet has received considerable attention as a potential weight-loss strategy.

Learn more about the keto diet, potential pitfalls, and what the research says: **hsph.me/ket20**

Intermittent Fasting

This diet regimen cycles between brief periods of fasting, with either no food or significant calorie reduction, and periods of unrestricted eating. The most common methods are fasting on alternate days, for whole days with a specific frequency per week, or during a set time frame.

Learn more about intermittent fasting, potential pitfalls, and what the research says: **hsph.me/int20**

Gluten-Free Diet

A gluten-free diet eliminates all foods containing or contaminated with gluten. As the sole treatment for the 1-2% of Americans who have celiac disease, this diet is not new. What is relatively new however, is the use of a gluten-free diet for weight loss.

Learn more about a gluten-free diet, potential pitfalls, and what the research says: **hsph.me/gfd20**

Spotlight: Caffeine

See an in-depth review on caffeine and health, and more info on caffeinated beverages: ***hsph.me/cfn20***

Many of us can't imagine starting the day without a cup of coffee. One reason may be that it supplies us with a jolt of caffeine, a mild stimulant to the central nervous system that quickly boosts our alertness and energy levels.[1]

ABSORPTION AND METABOLISM

The chemical name for the bitter white powder known as caffeine is 1,3,7 trimethylxanthine. Caffeine is absorbed within about 45 minutes after consuming, and peaks in the blood anywhere from 15 minutes to 2 hours.[2] Caffeine in beverages such as coffee, tea, and soda is quickly absorbed in the gut and dissolves in both the body's water and fat molecules. It is able to cross into the brain. Food or food components, such as fibers, in the gut can delay how quickly caffeine in the blood peaks. Therefore, drinking your morning coffee on an empty stomach might give you a quicker energy boost than if you drank it while eating breakfast.

Caffeine is broken down mainly in the liver. It can remain in the blood anywhere from 1.5 to 9.5 hours, depending on various factors.[2] Smoking speeds up the breakdown of caffeine, whereas pregnancy and oral contraceptives can slow the breakdown. During the third trimester of pregnancy, caffeine can remain in the body for up to 15 hours.[3]

People often develop a "caffeine tolerance" when taken regularly, which can reduce its stimulant effects unless a higher amount is consumed. When suddenly stopping all caffeine, withdrawal symptoms often follow such as irritability, headache, agitation, depressed mood, and fatigue. The symptoms are strongest within a few days after stopping caffeine, but tend to subside after about one week.[3] Tapering the amount gradually may help to reduce side effects.

RECOMMENDED AMOUNTS

Caffeine is naturally found in the fruit, leaves, and beans of coffee, cacao, and guarana plants. It is also added to beverages and supplements. There is a risk of drinking excess amounts of caffeinated beverages like soda and energy drinks because they are consumed chilled and are easy to digest quickly in large quantities.

The U.S. Food and Drug Administration considers 400 milligrams (about 4 cups brewed coffee) a safe amount of caffeine for healthy adults to consume daily. However, pregnant women should limit their caffeine intake to 200 mg a day (about 2 cups brewed coffee), according to the American College of Obstetricians and Gynecologists.

The American Academy of Pediatrics suggests that children under age 12 should not consume any food or beverages with caffeine. For adolescents 12 and older, caffeine intake should be limited to no more than 100 mg daily. This is the amount in two or three 12-ounce cans of cola.

SOURCES OF CAFFEINE

1 cup or 8 ounces of brewed **coffee** contains about 95 mg caffeine. The same amount of instant coffee contains about 60 mg caffeine. Decaffeinated coffee contains about 4 mg caffeine.

1 shot or 1.5 ounces of **espresso** contains about 65 mg caffeine.

8 ounces of black **tea** contains about 47 mg caffeine. Green tea contains about 28 mg. Decaffeinated tea contains 2 mg, and herbal contains none.

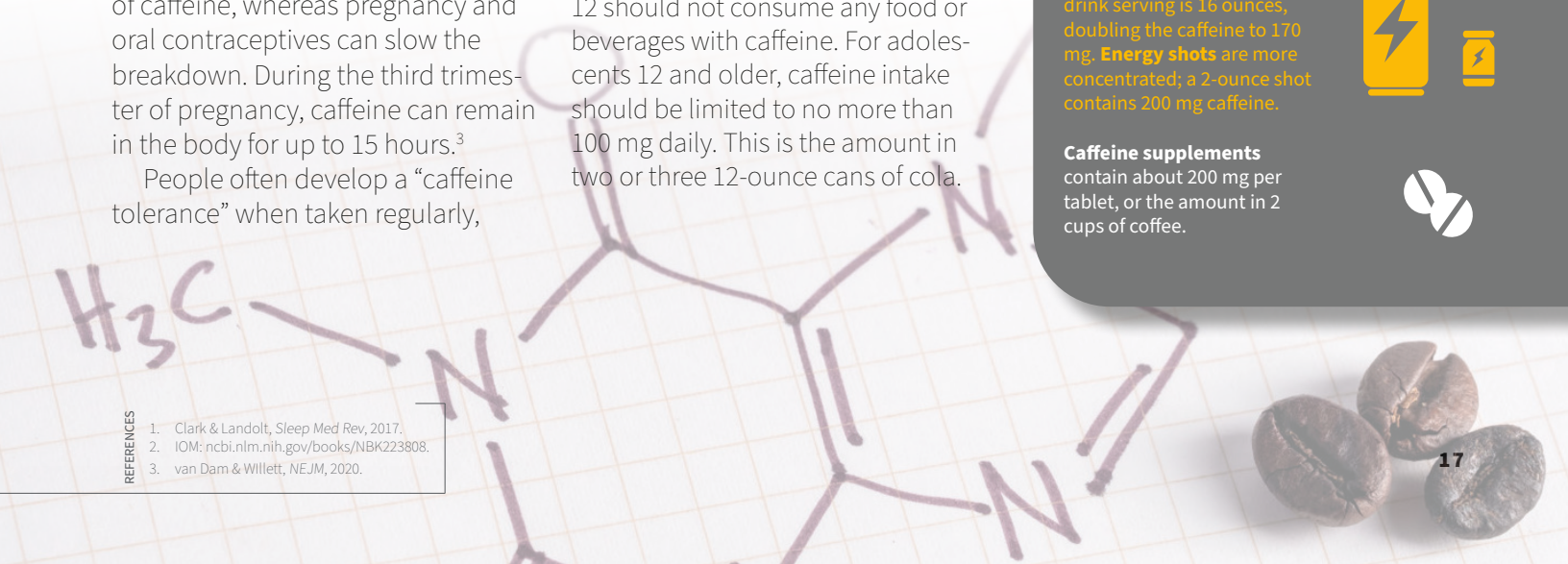
A 12-ounce can of regular or diet dark cola **soda** contains about 40 mg caffeine. The same amount of Mountain Dew contains 55 mg caffeine.

1 ounce of dark **chocolate** contains about 24 mg caffeine, whereas milk chocolate contains one-quarter of that amount.

Guarana seeds contain about four times the amount of caffeine as that found in coffee beans. Some drinks containing this seed extract can contain up to 125 mg caffeine per serving.

While 8 ounces of an **energy drink** contains about 85 mg caffeine, the standard energy drink serving is 16 ounces, doubling the caffeine to 170 mg. **Energy shots** are more concentrated; a 2-ounce shot contains 200 mg caffeine.

Caffeine supplements contain about 200 mg per tablet, or the amount in 2 cups of coffee.



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Staying Active

Beyond weight management, exercise plays a key role in our overall well-being.

Although many people view exercise as a way to lose weight, it plays a key role in the well-being of the body beyond weight loss. Research strongly supports its benefits across a range of physical and mental health conditions for people of all ages. However, busy lifestyles and an environment that encourages being sedentary for many hours of the day have led to exercise ranking low as a priority for many people.

CHOOSING AN EXERCISE

All exercises offer health benefits, and performing different types of exercises can expand the range of benefits even further. But it is important to remember that some exercise is better than none, and that most everyone can participate in some form of exercise safely.

Here are some factors to consider when choosing an exercise regimen:

- Frequency: How often will you do the activity—once a day, three times a week, twice a month?
- Duration: How long is the exercise session—20 minutes, 1 hour, 30 minutes split into two sessions in one day?
- Intensity: How much energy is needed—light versus vigorous activity?

TYPES OF EXERCISE

Aerobic/Cardiovascular physical activity—These are activities that are intense enough and performed long enough to maintain or improve one's heart and lung fitness. Examples: walking, jogging, dancing, bicycling, basketball, soccer, swimming.

Muscle-strengthening activity—This may be referred to as resistance training. These activities maintain or increase muscle strength, endurance, and power. Examples: weight machines, free weights, resistance elastic bands, Pilates, daily activities of living (lifting children, carrying groceries or laundry, climbing stairs).

Flexibility training—This may be referred to as stretching. It lengthens or flexes a skeletal muscle to the point of tension, and holds for several seconds to increase elasticity and range of motion around a joint. Improving flexibility can enhance the overall physical performance of other types of exercise. Examples: dynamic stretches performed with movement (yoga, tai chi), static stretches without movement (holding a pose for several seconds or longer), passive stretching (using an external force like a strap or wall to hold an elongated pose), and active stretching (holding a pose without an external force).

Balance training—These activities are intended to throw off one's balance to improve body control and stability. They can help to prevent falls and other injuries. Examples: standing on one foot, walking heel-to-toe in a perfectly straight line, standing on a balance or wobble board.

PHYSICAL ACTIVITY THROUGH THE LIFE COURSE

Guidelines for physical activity for different life stages and conditions:[4]

Children ages 3 through 5—Try to be physically active throughout the day. Adult caregivers should encourage children this age to engage in active playing for at least 3 hours daily.

Children and adolescents ages 6 through 17—At least 1 hour daily of moderate-to-vigorous activity with both aerobic and strength movements.

Adults—Move more frequently throughout the day and sit less. Engage in at least 150 to 300 minutes weekly (spaced throughout the week) of moderate-intensity aerobic exercise and at least 2 days weekly of muscle-strengthening exercises. Greater health benefits may be seen with more than 300 minutes weekly of exercise.

Women who are pregnant or postpartum—Aim for 150 minutes weekly (spaced throughout the week) of moderate-intensity aerobic exercise. If vigorous exercise was performed regularly prior to pregnancy, one may continue this throughout pregnancy after discussing with their doctor.

Adults with physical disabilities and chronic conditions—Follow similar activity guidelines as those for adults if able to exercise, but discuss with one's doctor about the types and amounts of activity that would be appropriate for specific conditions. Any exercises within one's ability is encouraged, to avoid being completely sedentary.

Older adults—Follow similar activity guidelines as those for adults but also focus on balance training. Discussing the start of a new exercise regimen with one's doctor is a good practice for all ages, but it's especially important with this age group because of the higher likelihood of having health conditions or physical limitations that may require modified exercises.

HOW ACCURATE ARE ACTIVITY TRACKERS?

Pedometers, heart rate monitors, and other wearable devices—often paired with smartphone apps—provide tracking tools to better manage personal health, and can be an effective source of motivational support.[1] But how reliable are they?

Generally these trackers are pretty accurate when measuring steps taken. But other measures, such as calories burned, may overestimate or underestimate. Studies looking at the accuracy of devices in tracking calories used while exercising tend to be small in size. In one study, 14 participants wearing different popular brand devices walked and ran. The estimated calorie usage displayed on the devices was compared with measurements from indirect calorimetry (a reliably accurate technique to measure calorie output). The results were mixed. Some of the devices were accurate for calorie expenditure with running but not walking and visa versa. Some of the devices overestimated the amount of calories used during exercise.[2] Other studies found similar discrepancies.[3]

Tracking devices can be useful for personal motivation and accountability, but the data should be interpreted with caution as there are variable readings among devices. The accuracy of the data may also vary within the same device when performing different intensities of exercise.[3] They are best used with other methods to gauge fitness levels, such as monitoring the frequency, duration, and perceived exertion of your exercise routine. It's also important to have motivation to exercise because you enjoy how you feel during and after the exercise, not just to reach a certain number on a tracker.

Learn more about tools for measuring physical activity, including the Borg Scale, METs, and target heart rate.
hsph.me/sa20

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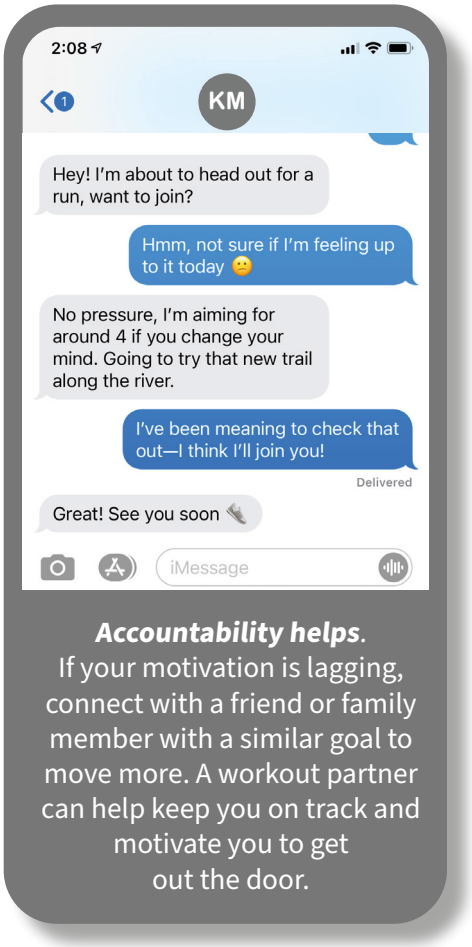
10 Tips to Keep Moving

Plan exercise into your day. Intention is an important first step. Set aside a specific time in your schedule to exercise and write it in your planner.

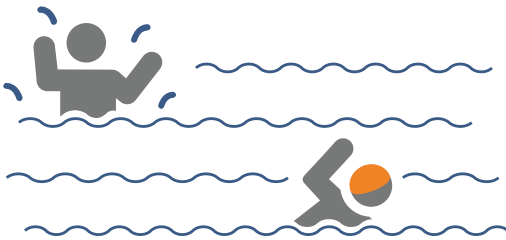
Try counting steps. Step-counting apps or pedometers are an easy way to remind yourself to move. Working up to 10,000 steps per day can be a good general goal. If that seems too intimidating, measure your steps on an average day and increase by 1,000 steps every two weeks.



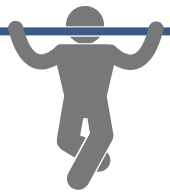
Accountability helps. If your motivation is lagging, connect with a friend or family member with a similar goal to move more. A workout partner can help keep you on track and motivate you to get out the door.

Keep it brisk. When you walk, make it brisk, since this may help control weight better than walking at a leisurely pace. What is brisk enough? Walk as though you are meeting someone for lunch and you are a little late.

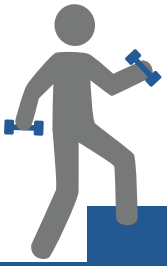
Turn off the TV, computer, and smart phone. Chances are that if you set aside these devices for an hour or two, you will automatically move more and curb your "sit time." Fill the time by doing household chores, running errands, playing with the kids, or taking a stroll around your neighborhood.

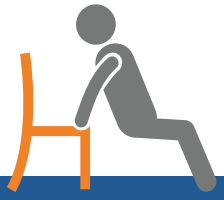


***Turn sit time into fit time**. Try to combine exercise with a sedentary activity that you already do. For example, perform basic exercises like squats, marching in place, jumping jacks, push-ups, or sit-ups while watching TV or throughout each commercial.*

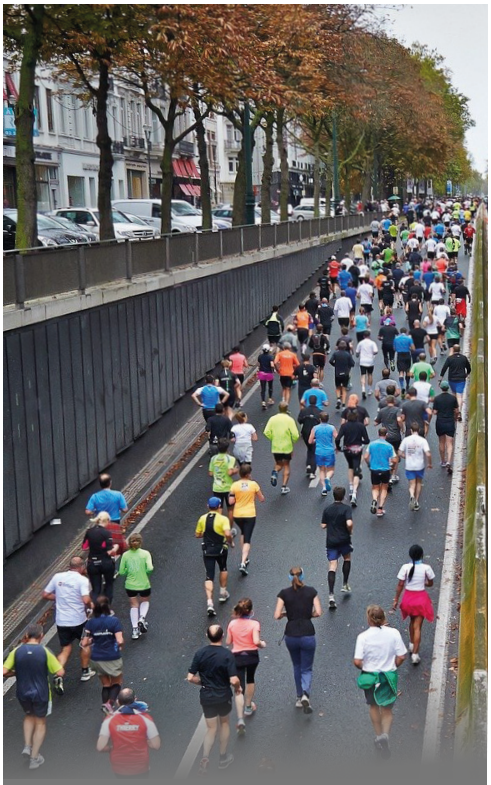


*For inspiration on how to move "creactively" wherever you are, check out VMove-Activating a Move-Friendly World: **hsph.me/vmv20***





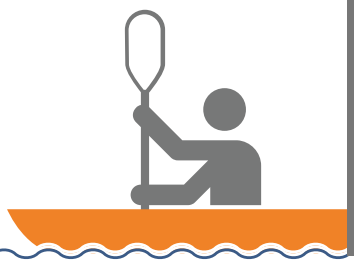
***Move at the office**. If you work long shifts or care for a busy family after hours, fitting in a workout can be daunting. So focus on moving at the office even if you have a sedentary desk job. Make climbing stairs and avoiding elevators the norm, park as far from the front office door as possible, set a reminder to get up and walk for 5 minutes each hour (that could add up to 40 minutes in a day!), or follow a short desk exercise video online.*



***Sign up for a class or an event**. Check out the fitness class schedule at your local gym, yoga studio, or community center. Some offer virtual classes with a live instructor which you can do at home. Or, sign up for a specific event like a road race or walk-for-charity a few months out; this can help drive you to train regularly in the weeks leading up to the event. You may find that having a target date or the structure of a weekly class keeps you consistent.*

***Reward yourself**. Set short-term goals—then acknowledge and reward yourself when achieving them. Positive affirmations are key to building confidence as you commit to ongoing fitness goals. Treat yourself to new exercise shoes, clothing, or workout gear; a new book; or a massage.*

***Split the workout**. If you are new to exercise and find a 30-minute session challenging, split it into two 15-minute sessions. The fitness benefit may actually be greater if you can exercise with higher energy and intensity in two shorter bouts, than if you tried to exercise for 30 minutes but slowed down from fatigue towards the end.*



Exercise Safety

Using caution and patience can reduce the risk of injuries.

Safety should be a major priority when exercising. Any physical activity carries the risk of injury, whether you are just starting an exercise regimen or are a seasoned fitness buff. But don't let this stop you from moving because the health benefits of being active far outweigh any risks.

Learn more about exercise safety and how to avoid common missteps: ***hsph.me/exs20***

Ways to Get Started Safely

If you are often sedentary, start with activities that are lower impact and require a light-to-moderate effort, such as walking, gardening, stationary bicycling, or swimming. Progress gradually—it's especially important to "start low and go slow." Also, if you have a chronic health condition or are pregnant, let your doctor know of your plan to start exercising.

- ***Protect yourself:***
  - ***Choose the right equipment.*** If you're cycling, wear a bike helmet. If you're going out for a walk, pull on a well-fitting pair of sneakers instead of a pair of flip flops. Generally, exercise shoes should be replaced every 4-6 months as the cushioning wears out.
  - ***Find a safe place to work out.*** Seek out streets that have sidewalks or bicycle lanes, or visit a local park. Play basketball on well-maintained courts.
  - ***Pay attention to the weather.*** In the middle of a heat wave, exercise in the morning or evening when it's cooler out, exercise indoors, or hit the swimming pool instead of the tennis court. Be aware of signs of overheating like dizziness, nausea, headache, cramping, and a racing heart rate that doesn't slow down even when stopping the exercise.
- ***Stay hydrated with water.*** The amount will vary depending on the temperature (more is needed in hot conditions) and level of exercise. For moderate workouts of one hour or less, bring about 24 ounces of water to drink during and after exercising.
- ***Choose healthy "fuel."*** A diet with adequate amounts of healthy protein and carbohydrates is sufficient to fuel the body for low to moderate amounts of physical activity, such as an hour of jogging or bicycling.
- ***Be wary of supplement claims.*** Advertisements touting workout supplements as crucial for peak performance, fat loss, and explosive muscle growth might have you believing you can't effectively exercise without them. Although some supplements have been researched for use in regular high-intensity, strenuous physical activity (such as marathon training or power lifting), it's important to note they are not regulated for safety. Be sure to consult with a doctor before incorporating supplements into your exercise routine and discuss if there are any potential contraindications if you have existing medical conditions.
- ***Listen to your body.*** If you feel very fatigued, pain, or lightheaded, slow down the workout or end it early.

Spotlight: Walking

See the research on walking for exercise and health, along with tips for planning a safe walking routine: ***hsph.me/wlk20***

Walking is one of the most popular forms of exercise worldwide. It doesn't require expensive equipment or special skills, and it provides a wide range of health benefits. Whether you choose an outdoor solitary path in nature, a busy route on city sidewalks, a treadmill workout, or a few rounds around your office building, walking is a relatively accessible way to stay active.

Walking is a type of cardiovascular physical activity, which increases your heart rate. This improves blood flow and can lower blood pressure. It helps to boost energy levels by releasing certain hormones like endorphins and delivering oxygen throughout the body. Brisk walking is considered a moderate-intensity, low-impact workout that does not exert excess strain on joints (hip, knee, ankle) that are susceptible to injury with higher-impact workouts.

WALKING AND HEALTH

People may think that walking is not as effective as higher-impact workouts. Yet a large cohort study of runners and walkers found that after 6 years of follow-up, when expending an equal amount of energy, moderate-intensity walking offered similar benefits as higher-intensity running in reducing the risk of high blood pressure, high cholesterol, and diabetes.[1] The faster the walking pace, the greater the risk reduction observed.

The 2018 Physical Activity Guidelines recommends that adults with chronic conditions do at least 150-300 minutes of moderate-intensity aerobic physical activity weekly, if able.[2] Walking is an exercise that meets this aerobic component and is associated with improving high blood pressure and body mass index, and lowering the risk of diabetes, stroke, and cardiovascular disease, and early death.[3] Walking speed, duration, and frequency can be adjusted depending on one's starting fitness level.

MINDFUL WALKING

The fitness benefits are clear, but what you may not realize is that walking may also offer psychological perks. These come from increasing our awareness of the sights and sounds that are beyond our step counter and music playlist. An example might be looking at nature (trees, flowers, clouds) or paying attention to people or events happening as we walk past. Buddhist monks practice walking meditations, which concentrates on the movement or position of the arms, legs, or feet while walking, which leads to increased relaxation. Some studies have shown that this form of mindful walking can reduce blood pressure and depression.[4] Other studies have found that walking in nature, such as in a forest or alongside a river, can decrease negative moods like depression, anxiety, anger, fatigue, and confusion.[5,6]

Do I really need to take 10,000 steps per day?

It may surprise you to learn that the benchmark number of 10,000 steps is not based on science but was created as a marketing tactic in the 1960s by a company making pedometers.

So is there any evidence to support stepping it up? Generally, research finds that more steps are better but even a lower amount can achieve health benefits. There's nothing wrong with aiming for 10,000 steps or even higher, except when it becomes so daunting that you lose motivation, or you feel discouraged that a lesser amount is not good enough. Rather than feeling chained to a specific step count, listen to your body, challenge it, and feel good about what it can accomplish!

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Stress and Health

Learn more about the impacts of chronic stress: **hsph.me/str20**

Understanding the impacts of stress on eating patterns and health, and strategies that may help control it.

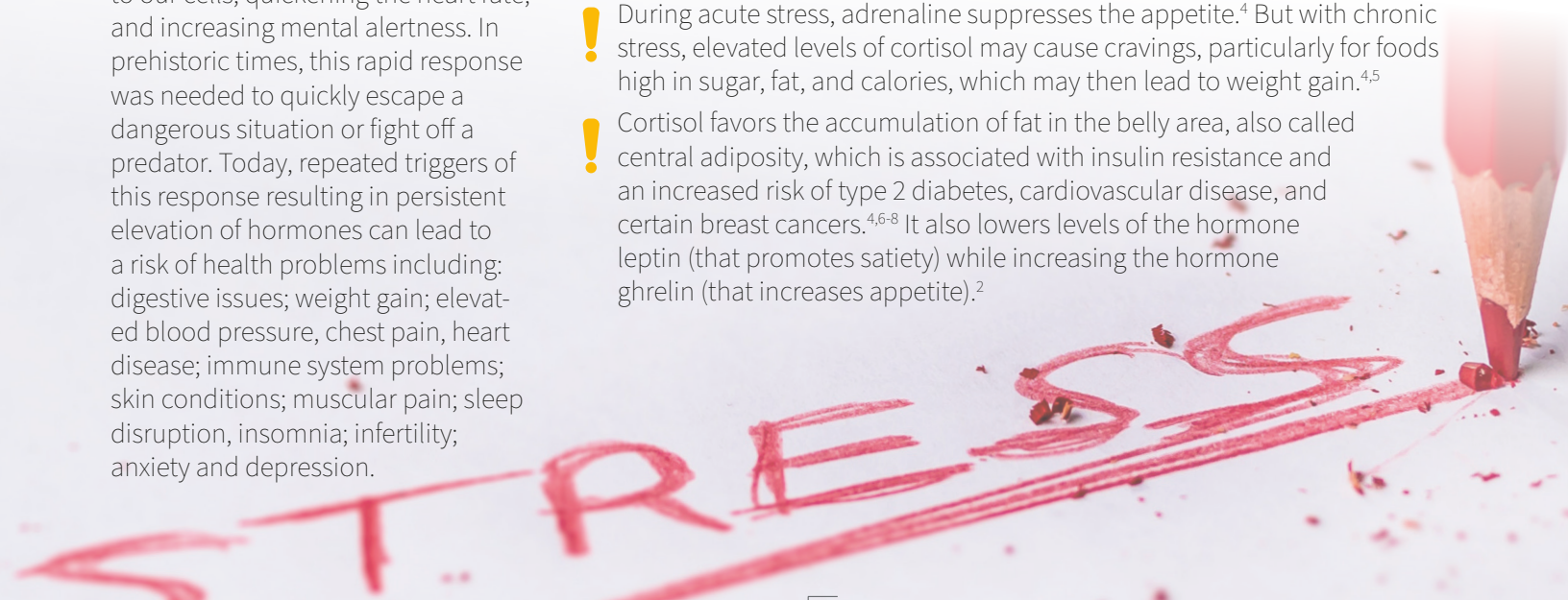
Stress is a common problem in most societies. There are three main types of stress that may occur in our everyday lives: acute (a brief event such as a heated argument or getting stuck in a traffic jam), acute episodic (frequent events such as work deadlines), and chronic stress (persistent events like unemployment from a job loss, physical or mental abuse, substance abuse, or family conflict). Many of us may experience a combination of these three types.

Our bodies react to all types of stress via the same mechanism, which occurs regardless if the stress arises from a real or perceived event. Both acute and chronic stressors cause the "fight-or-flight" response. Hormones are released that instigate several actions within seconds: pumping blood and oxygen quickly to our cells, quickening the heart rate, and increasing mental alertness. In prehistoric times, this rapid response was needed to quickly escape a dangerous situation or fight off a predator. Today, repeated triggers of this response resulting in persistent elevation of hormones can lead to a risk of health problems including: digestive issues; weight gain; elevated blood pressure, chest pain, heart disease; immune system problems; skin conditions; muscular pain; sleep disruption, insomnia; infertility; anxiety and depression.

HOW DOES CHRONIC STRESS AFFECT EATING PATTERNS?

Chronic stress can affect the body's use of calories and nutrients in various ways. It raises the body's metabolic needs and increases the use and excretion of many nutrients. If one does not eat a nutritious diet, a deficiency may occur.[1] Stress also creates a chain reaction of behaviors that can negatively affect eating habits, leading to other health problems down the road.

- Stress places a greater demand on the body for oxygen, energy, and nutrients. Yet people who experience chronic stress may crave comforting foods such as highly processed snacks or sweets, which can be high in unhealthy fats, sugar, and calories but low in micronutrients.[2]
- People feeling stress may lack the time or motivation to prepare nutritious, balanced meals, or may skip or forget to eat meals.
- Stress can disrupt sleep by causing lighter sleep or more frequent awakenings, which leads to fatigue during the day.[3] In order to cope with daytime fatigue, people may use stimulants to increase energy such as with caffeine or high-calorie snack foods. The reverse may also be true that poor-quality sleep is itself a stressor. Studies have found that sleep restriction causes a significant increase in cortisol levels.[3]
- During acute stress, adrenaline suppresses the appetite.[4] But with chronic stress, elevated levels of cortisol may cause cravings, particularly for foods high in sugar, fat, and calories, which may then lead to weight gain.[4,5]
- Cortisol favors the accumulation of fat in the belly area, also called central adiposity, which is associated with insulin resistance and an increased risk of type 2 diabetes, cardiovascular disease, and certain breast cancers.[4,6-8] It also lowers levels of the hormone leptin (that promotes satiety) while increasing the hormone ghrelin (that increases appetite).[2]



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Healthy diet. A balanced diet can support a healthy immune system and the repair of damaged cells. It provides the extra energy needed to cope with stressful events. Early research suggests that certain foods like polyunsaturated fats, including omega-3 fats, and vegetables may help to regulate cortisol levels.

Mindful eating. Mindful eating practices can help counteract “stress-eating” by encouraging deep breaths, making thoughtful food choices, focusing attention on the meal, and chewing food slowly and thoroughly. Mindful eating can also help us realize when we are eating not because of physiological hunger but because of psychological turbulence.

Regular exercise. Physical activity will help to lower blood pressure and stress hormone levels. Aerobic exercise like walking and dancing increases breathing and heart rate so that more oxygen reaches cells throughout the body. This reduces tension in muscles, including the heart.

Meditation or deep breathing. Fast, shallow breathing and erratic thoughts occur in response to stress. Therefore, take slow deep breaths to reduce muscular tension, lower the heart rate, and calm the mind. Whenever you feel stressed, breathe slowly, focusing on each in- and out-breath. Through this simple act, your parasympathetic nervous system kicks in and can help you calm down.

Mental health counseling or other social support. Feeling alone can add to stress. It can help to talk through feelings and concerns with a trusted individual. Often, just realizing that you are not alone and that your feelings are not unusual can help lower stress.

Good sleep hygiene. Stress can cause a heightened sense of alertness, which delays the onset of sleep, as well as cause interrupted sleep throughout the night. This can prevent one from entering the deeper sleep stages in which the body repairs and grows tissue and supports a healthy immune system. The REM (rapid eye movement) sleep stage in particular helps with mood regulation and memory.

Work-life balance. Use vacation and personal time, or just set aside an hour a day. A periodic escape from the pressures of work can do wonders to reduce stress, increase productivity, and decrease the risk of physical and mental illnesses that are associated with workplace burnout.

Schedule fun activities or hobbies at least once a week. Gardening, reading, enjoying music, getting a massage, hiking in nature, and cooking a favorite recipe are examples of welcome stress relievers.

Tips to Help Control Stress

Sleep

Sleep is as essential to our daily needs as food and water.

Sleep plays a critical role in brain as well as physical functioning. Although we may feel that sleep simply rests our tired bodies, our brains remain active throughout the night.

WHAT HAPPENS DURING SLEEP?

Our internal body clock, called a circadian clock, tells us when we are ready to sleep. There are actually several circadian clocks in the body, found in the brain and other organs. They are triggered by cues such as daylight (we feel alert) and darkness (we feel drowsy). These clocks can also be triggered by artificial bright light or stimulants like caffeine and alcohol that cause us to feel awake even if it is nighttime.

There are several phases of sleep our body experiences. They are classified as REM (rapid eye movement) and non-REM sleep. We cycle repeatedly through these phases about 4-6 times throughout the night, and it is not uncommon to wake up briefly between cycles.

Non-REM sleep:

- *Stage 1*. You transition from being awake to a restful state.
- *Stage 2*. You are in a light sleep state. Your breathing, heart rate, and muscle movements slow down. Brain activity also slows, and your body temperature drops.
- *Stage 3*. You are in a deep sleep state. This stage often occurs early in the sleep cycle immediately following light sleep. Your heart rate and breathing are the slowest during this phase, and you are not easily awakened. Events of the day are processed and stored in your memory. A lack of deep sleep can leave one feeling tired in the morning even if achieving an adequate duration of sleep.

REM sleep:

During REM, your pupils twitch and move quickly from side to side underneath closed eyelids. Brain activity rises as you breathe faster and your heart rate increases. It's the phase when dreams are most common, and certain nerves signal your limbs to become temporarily paralyzed so you don't act out the dream. REM tends to occur later at night and into early morning. Memory is processed and stored during REM sleep.

HOW MUCH SLEEP DO WE NEED?

Sleep needs change as we age, with the average person generally requiring less sleep at older ages. However, specific sleep amounts vary by individual. According to the National Sleep Foundation and American Academy of Sleep Medicine (AASM), newborns need the most sleep, at 14-17 hours a day, followed by infants at 12-16 hours a day including naps. Toddlers need about 10-14 hours a day. Preteens and teenagers need about 8-12 hours a day, and adults about 7-8 hours a day.[1] A consensus by the AASM and Sleep Research Society recommends that adults should sleep 7 or more hours a night to promote optimal health.[2]

Despite these general recommendations on sleep duration, individual differences in sleep requirements exist. In most epidemiologic studies, increased risk of adverse health outcomes such as obesity, diabetes, and cardiovascular disease has been observed among those who reported sleeping 5 hours or less per day, and 9 hours or more per day. Thus, a range of sleep hours (more than 5 and less than 9) is considered appropriate for most healthy adults.

Other factors such as quality of sleep are important, because just meeting the total recommended sleep hours may not be enough if one wakes up frequently in the night. A common belief is that lost sleep from a late night out or studying can be recovered by "sleeping in" another day or taking naps. However, both of these methods disrupt the body's circadian rhythms and may deprive the body of deeper sleep stages. Although some epidemiologic studies have shown that taking a short nap during the day may reduce risk of cardiovascular disease, increased variability in how much sleep we get from night to night is associated with an increased risk of developing metabolic and heart diseases.[3] It is important to respond, whenever possible, to the body's natural signals of sleepiness.

Sleep Hygiene Tips

- Set a sleep schedule and stick to it. Try to go to bed at night and awaken in the morning around the same times, even on weekends. This helps to regulate the body's sleep cycles and circadian rhythms.
- Try to exercise at some point in the day but avoid vigorous activity (running, fast dancing, high-intensity interval training) one hour before bedtime. Regular exercise of adequate intensity can promote muscle relaxation and deeper sleep later on.
- If you're in the habit of napping during the day, aim for a 10-20 minute power nap to achieve the goals of reduced fatigue and increased alertness. It's best to take naps in the early afternoon to avoid interference with nighttime sleep.
- Try to avoid large meals, heavy snacking, or alcohol 2-3 hours before bed.
- If you are sensitive to caffeine, try to avoid drinking caffeinated beverages 4-6 hours before bedtime.
- Stop using electronic devices an hour before bed, especially those emitting blue light such as smartphones, tablets, and televisions.
- Schedule before-bed activities to signal that you are winding down, such as changing into pajamas and brushing teeth.
- Create a quiet, dark, relaxing environment in your bedroom. Dim the lights and turn off your cell phone's sound and vibration modes if possible.
- Ensure a comfortable temperature, as feeling too hot or cold can disrupt sleep.
- Create calming bedtime rituals such as practicing deep breathing exercises, doing light yoga stretches, or listening to soothing relaxing music.
- If you awaken and can't return to sleep, don't stay in bed. Get up and do quiet relaxing activities, such as reading, until you feel tired enough to fall back asleep.

DREAMS

WHY DO WE DREAM? Dreams occur during the REM sleep stage and may include thoughts or events you recently experienced. Dreams may occur to help process emotions caused by those events. People report dreaming in vivid color as well as in black and white. Sometimes even a wild dream can be forgotten by the time we awaken in the morning.

IMMEDIATE EFFECTS OF SLEEP DEPRIVATION

About one-third of American adults do not get enough sleep each night.[4,5] Short sleep duration in adults is defined as less than 7 hours of sleep in 24 hours. About 40% of adults report unintentionally falling asleep during the day at least once a month, and up to 70 million Americans have chronic sleep problems. Because of the public health burden of poor sleep health, achieving sufficient sleep in children and adults was included as a goal in the Healthy People 2020 goals.[6]

Sleep helps to process your thoughts from the day as well as store memories, so a lack of good-quality sleep can lead to difficulty focusing and thinking clearly. You may feel tired, irritable, or anxious during the day. Performance at work or school may suffer. Your reaction time may be slowed, increasing the risk of driving accidents.

In children, insufficient sleep can lead to attention and behavior problems or hyperactivity. In the elderly, lack of sleep may decrease focus and attention, leading to a greater risk of falls, bone fractures, and car accidents. There are several reasons people may get insufficient sleep:

- Poor sleep habits (watching television or using screens late at night, drinking caffeinated or alcoholic beverages at night, not following a regular sleep schedule).
- Your sleep environment is too noisy, too light, or otherwise not conducive to sleep.
- You attempt to sleep outside of the body's natural circadian clock (working an overnight shift and trying to make up for sleep during the day).
- You have a sleep disorder, such as sleep apnea, insomnia, or periodic limb movements that reduces deep or REM sleep or causes frequent awakenings.
- You have a medical condition such as heart, lung, or kidney disease, or chronic pain, which causes frequent awakenings.

SLEEP DEFICIENCY AND DISEASE

If you experience continued sleep deprivation, you will develop a condition called sleep deficiency. This is a state in which you cannot make up the many lost hours of sleep. Sleep deficiency increases the risk of obesity, diabetes, cardiovascular disease, depression, and even early death.

See the research on sleep deficiency and disease risk, and learn more strategies for sleeping well: ***hsph.me/sle20***

SLEEP DEFICIENCY AND EATING BEHAVIORS

Epidemiological studies show that insufficient sleep is independently associated with a higher risk of obesity. Clinical studies of sleep-restricted adults show an increased hunger and calorie intake when participants are allowed free access to food.[7] A preference for late evening or nighttime food intake and increased snacking has been observed.[8] There also appears to be a food preference for

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foods higher in carbohydrate and fat, which could partly explain the overall higher calorie intake.

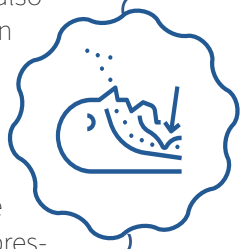
Changes in hormone levels that signal either hunger or satiety have also been observed in clinical sleep restriction studies. Leptin is a hormone associated with satisfaction. When food enters the stomach, leptin is released from fat cells and travels to the brain where it signals the body to stop eating by creating a sensation of fullness. People with obesity may actually have very high levels of leptin; the more body fat one has, the more leptin is produced in fat cells. However, a condition called leptin resistance may occur in which the brain does not receive the usual signal from leptin to stop eating. In response, more and more leptin is released. Lower leptin levels as well as high leptin levels suggesting leptin resistance have been observed in sleep-deprived adults.[7]

Ghrelin, the "hunger hormone," typically has the opposing action of leptin. It is released in the gut and sends hunger signals to the brain when someone is not eating enough. About three hours after eating a meal, ghrelin levels drop. Clinical studies have found that sleep restriction leads to elevated ghrelin levels.[8]

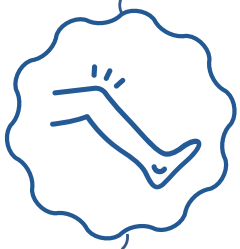
Despite this interesting theory of poor sleep leading to changes in appetite hormone levels, other studies have found no changes and therefore the association is still inconclusive.[8] Conflicting findings may be due to differences in the study participants (e.g. age, gender) and differences in how the researchers defined the duration and severity of sleep restriction.

MEDICAL CONDITIONS THAT INTERFERE WITH SLEEP

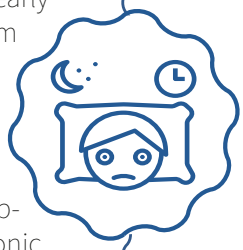
Obstructive sleep apnea (OSA)—Symptoms of OSA include snoring or gasping for air that causes interruptions in sleep and prevention of good-quality sleep. OSA also causes oxygen levels to drop during sleep, which can pose a stress on the heart, brain, and other organs. People with OSA may not be aware that they are awakening frequently in the night, but do not get refreshed sleep, feeling excessively sleepy or tired during the day. Continuous positive airway pressure (CPAP) devices may be prescribed, which provides pressurized air to the nose and throat, preventing the upper airway from collapsing. Another common treatment is dental devices that move the jaw forward and increase the airway size.



Restless leg syndrome—This condition is associated with discomfort in the legs accompanied by an urge to move, which disrupts sleep. It is believed that abnormal levels of the neurotransmitter dopamine may be responsible, so medications are given to correct this. In some cases, low levels of iron can result in this disorder.



Insomnia—This condition is defined as the inability to sleep or stay asleep. An individual may have a hard time falling asleep, or may sleep but then awaken in the early morning and be unable to return to sleep. Short-term insomnia can be caused by stress or traumatic events (divorce, job loss, death of a loved one). Chronic or long-term insomnia may be caused by ongoing anxiety, working different work shifts that disrupt the body's circadian rhythms, poor sleep habits, medical conditions that can interrupt sleep (chronic pain, gastroesophageal reflux disease), or medications that have a stimulating effect. Insomnia often can be treated with behavioral therapies, although sometimes sleep medications are prescribed.



Genetic—Studies have found specific gene variants associated with insomnia.[9,10] The same genes for insomnia were also associated with higher levels of body fat, depression, and heart disease. Research has also found that sleep apnea clusters within families, and genes have been identified that appear to increase risk for sleep apnea as well as cardiovascular disease.[11] More research is needed in this area.

Try a new type of exercise	Turn off screens at least 1 hour before going to bed	Plan vacation or personal time away from work	Alternate between sitting and standing throughout the day	Try a new fruit
Prepare a dinner using the Healthy Eating Plate as a guide	Find a workout buddy	Shop your pantry and use what you have before buying more to minimize food waste	Spend time doing a fun activity or favorite hobby	Schedule exercise time in your calendar
Put on some favorite music and dance!	Set an alarm for intervals throughout the day; when it rings, breathe for 2 minutes	HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH Department of Nutrition	Design a meal plan for the upcoming week	Find your ideal sleep schedule and aim to stick to it
Take a walk without screens or headphones; see what you notice	Freeze leftovers you won't eat right away for an easy future meal	Set a long- or short-term fitness goal	Create a calming bedtime ritual (deep breathing, music, etc.)	Practice mindful eating for at least a portion of a meal
Try a new whole grain	Avoid large meals, heavy snacking, or alcohol 2-3 hours before bed	Try an aerobic activity while watching TV	Prepare a meal featuring lentils (or another legume)	Try a new vegetable

Play the healthy living bingo challenge!