

HOW WE EAT THE CURRENT STATE OF NUTRITION IN AMERICA



INTRODUCTION


American Academy of PAs (AAPA) is developing a nutrition-focused national collaborative sponsored by Abbott to empower physician assistants (PAs) to elevate their role in nutrition counseling in everyday practice. PAs are on the front lines of patient care and routinely face questions from individuals about nutrition topics, and consequently, are in a unique position to initiate discussions, as well as provide guidance and education focused on lifestyle changes and ways to improve nutritional decision-making. However, most healthcare professionals receive limited training on the fundamental principles of nutrition and nutrition intervention strategies. This initiative is intended to build upon current knowledge and further prepare PAs to discuss nutrition with patients, as well as identify individuals who would benefit from nutrition guidance and intervention approaches. PAs will also be empowered to recognize individuals with complex nutritional issues and be able to quickly refer these patients to a registered dietitian.

IN THIS ISSUE

- Current Trends in Nutrition Intake in the United States
- Macronutrients
- Nutrition Requirements
- Where to Start?
Small Changes, Big Results
- Conclusion

The collaborative will include quarterly themes designed to incrementally build knowledge, competence, and performance, with the goal of creating a shift in clinical practice that incorporates nutritional strategies for better patient care. This first theme will focus on improving knowledge related to current trends in *nutrition*, *macronutrients*, and *nutrition requirements*. The benefits of nutrition intervention will also be highlighted.

ADEQUATE NUTRITION IS THE CORNERSTONE FOR GOOD HEALTH AND DISEASE PREVENTION THROUGHOUT THE LIFESPAN, WHILE IMPROPER NUTRITION IS ASSOCIATED WITH CHRONIC DISEASES, INCLUDING OBESITY, DIABETES, CARDIOVASCULAR DISEASE, OSTEOPOROSIS, AND CANCER.¹



Nearly half of all Americans suffer from one or more preventable chronic diseases that are related to nutrition.¹

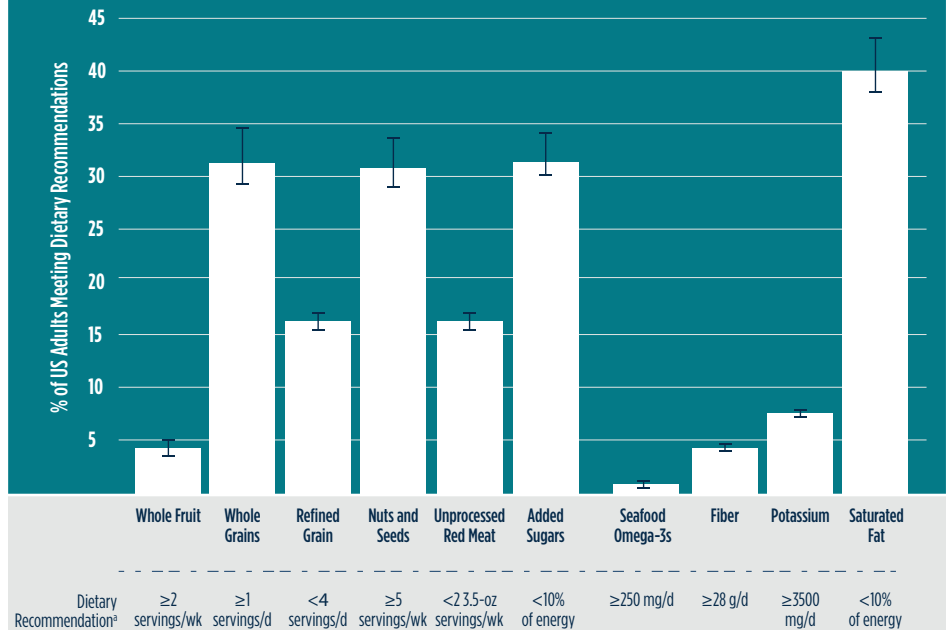
Of the **\$3.5 trillion** spent in the United States on healthcare each year, **more than 80% of these costs are spent on managing chronic diseases.⁶** More than **\$33 billion** in medical costs and **\$9 billion** in lost productivity for heart disease, cancer, stroke, and diabetes are attributed to poor nutrition.⁷

Poor nutrition contributes more to disease burden than either physical inactivity or body mass index (BMI).² Individuals with scores in the lowest quintile on the Healthy Eating Index (HEI), an index that assesses consistency of nutrition intake with the Dietary Guidelines for Americans, are 13%–23% more likely to experience premature death vs individuals with scores in the highest quintile.³ In fact, suboptimal diet is the leading risk factor for death and disability among Americans,^{2,4} and is associated with 26% of deaths and 14% of disability-adjusted life years.² In individuals with heart disease, stroke, and diabetes, poor nutrition (defined as low consumption of fruits, vegetables, nuts/seeds, whole grains, unprocessed red meats, polyunsaturated fats and seafood omega-3 fats, and high consumption of processed meats, sugar-sweetened beverages, and sodium) is associated with nearly half of all cardiometabolic deaths.⁵

HOW WE EAT CURRENT TRENDS IN NUTRITION INTAKE IN THE UNITED STATES

A study by Rehm and colleagues characterized trends in dietary factors related to major diseases or special public interest.⁸ This study utilized National Health and Nutrition Examination Survey (NHANES) data between 1999 and 2012. Over this time, the consumption patterns of total fruits and vegetables, red meat and processed meat, and dairy, as well as total fat and saturated fat, remained stable. Increases in the consumption of whole grains, nuts, eggs, seafood, polyunsaturated fat, and protein were observed, while decreases were observed in refined grains, sugar-sweetened beverages, added sugars, monounsaturated fat, and carbohydrates. Thus, there have been improvements over time in many aspects of the American diet. However, as the authors pointed out, only a small number of Americans are actually achieving the recommended levels of the majority of dietary factors (Figure 1).⁸ For example, **less than 1 in 6 adults are consuming enough vegetables, fruits, or seafood**, and **less than 1 in 50 are consuming sufficient levels of whole grains**.⁸ While only a small percentage of adults younger than 50 years of age consume too little protein,⁹ **approximately 31% of males and 45% of females 51-60 years are not meeting their recommended level of protein intake**.¹⁰ Furthermore, while approximately 1 in 2 adults is now at or below recommended levels for sugar-sweetened beverages, **fewer than 1 in 3 adults is at or below recommended intake levels for added sugars**.⁸ In addition, more than 80% consume refined grains, processed meats, and unprocessed red meats in excess of the recommended levels, and 60% consume more saturated fat than recommended.

FIGURE 1. Proportion of US Adults Meeting Dietary Recommendations 2009-2012⁸



^a Based on the Dietary Guidelines for Americans Dietary Reference Values, the Global Burden of Diseases Study, and other alternative cutoffs. d, day; oz, ounce; US, United States; wk, week.

Dietary Recommendation



LESS THAN 1 IN 6 ADULTS ARE CONSUMING ENOUGH VEGETABLES, FRUITS, OR SEAFOOD



~31% OF MALES AND 45% OF FEMALES 51-60 YEARS OF AGE ARE NOT MEETING THEIR RECOMMENDED LEVEL OF PROTEIN INTAKE



FEWER THAN 1 IN 3 ADULTS IS AT OR BELOW RECOMMENDED INTAKE LEVELS FOR ADDED SUGARS

HOW WE EAT

CURRENT TRENDS IN NUTRITION INTAKE IN THE UNITED STATES

Nearly every American consumes more sodium than recommended.⁸

According to the American Heart Association, **41% of adults 20 years of age or older meet criteria for having a poor diet, while only 1.5% meet criteria for having a healthy diet** (see table for criteria for a healthy diet).⁷ Many Americans are not achieving recommended dietary targets, and there are subgroups in particular that face nutritional challenges. On average, diet quality tends to be worse in males,¹¹ younger adults,¹¹ and smokers.¹²

More than 15% of community-dwelling elderly (>65 years) are at risk for undernutrition and up to 50% of hospitalized elderly and 60% of institutionalized elderly are also at risk for or suffer from malnutrition.¹³

Among adults with prediabetes, controlled diabetes, and poorly controlled diabetes, diet quality, measured by the HEI, is significantly worse across each level of glycemic control.¹⁴ Income also factors into nutritional choices.

The proportion of highest income families with a poor diet was 36% in one study, compared with 60% of those with the lowest family income.⁷

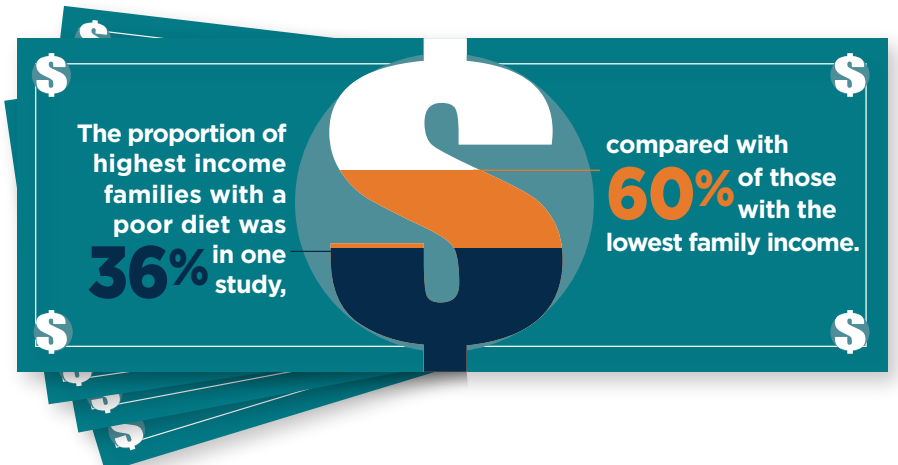
More specifically, Americans of lower socioeconomic status, as well as non-Hispanic blacks and Mexican-Americans, have lower intake of vegetables, whole grains, unprocessed red meat, and milk.⁸ In addition, refined grain consumption has increased among Mexican-Americans, and sodium intake has increased among both Mexican-Americans and non-Hispanic blacks.⁸



Healthy Diet									
Whole Fruit	Whole Grains	Refined Grain	Nuts and Seeds	Unprocessed Red Meat	Added Sugars	Seafood Omega-3s	Fiber	Potassium	Saturated Fat
≥2 servings/wk	≥1 servings/d	<4 servings/d	≥5 servings/wk	<2.35-oz servings/wk	<10% of energy	≥250 mg/d	≥28 g/d	≥3500 mg/d	<10% of energy

>15% of community-dwelling elderly (>65 years) are at risk for undernutrition

Up to 50% of hospitalized elderly & 60% of institutionalized elderly are also at risk for or suffer from malnutrition



HOW WE EAT CURRENT TRENDS IN NUTRITION INTAKE IN THE UNITED STATES

Snacks and sweets have become a significant portion of daily dietary intake.

Between 40% and 50% of adults consume 2 to 3 snacks per day, with approximately one-third consuming 4 or more snacks per day.¹ Nearly 25% of daily energy intake is from snacks.¹⁵ Moreover, snacks and sweets account for over 30% of added sugars in the United States and 25% of added sodium.¹¹⁶ Snacks and sweets are also among the food categories that provide the most saturated fat. Both the frequency and energy density of snacks have increased over time.¹⁵ A recent study among adults aged 30 years and older reported that refined grains accounted for up to 90% of the grains from snacks.¹⁷ In this study, the average snack contained only 1 gram of fiber, but contained 181 kcal: 104 calories (26 grams) from carbohydrates and 52 calories (13 grams) from added sugars. The highest calorie snack contained less than 2.5 grams of fiber and 380 kcal: 188 calories (47 grams) from carbohydrates, and 92 calories (23 grams) from added sugars. It has also been observed that individuals consume approximately 480 mg of sodium per snack,¹⁶ which adds up to 560 to 1440 mg, or one quarter to two-thirds, of the total recommended daily intake if individuals are consuming 2 to 3 snacks per day.¹

SNACKS ARE DESCRIBED BASED ON THE TIME OF DAY FOOD IS CONSUMED, TYPE OF FOOD, AMOUNT OF FOOD, OR LOCATION OF FOOD CONSUMPTION.

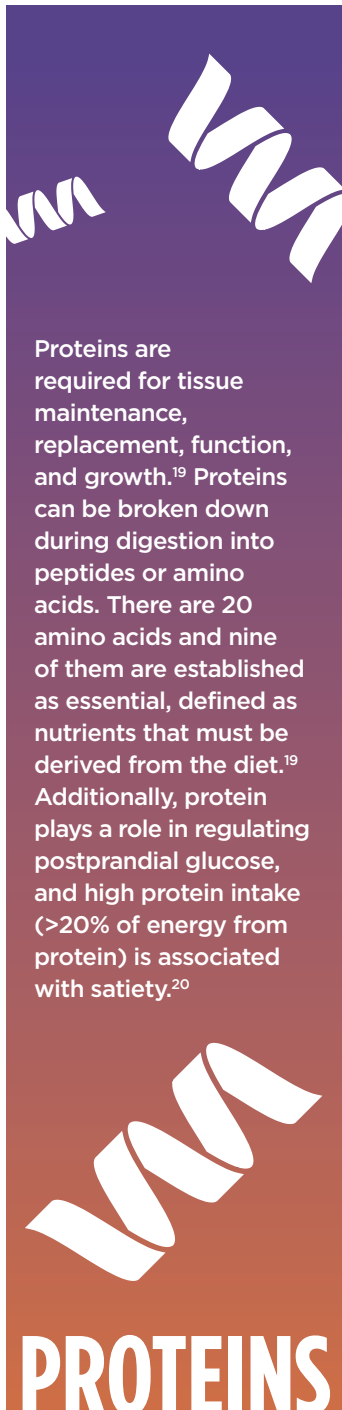


Regardless of the definition of a snack, it is clear that the prevalence of snacking in America has increased dramatically. The data on the healthfulness of snacking is varied. In individuals who skip meals but eat several snacks, data suggest a less healthy overall nutrient intake compared to individuals who eat three meals with or without snacks. Individuals who skip breakfast specifically but eat two snacks have the lowest intake of all micronutrients except sodium.⁴⁵ Additionally, people report feeling less satiated following a snack vs a meal, even when the calories associated with each eating event are the same. Consequently, individuals tend to consume more calories when eating after a snack vs a meal.⁴⁶ Generally, snacking in the absence of hunger leads to poor nutrition.⁴⁷ Conversely, snacking when hungry leads to consumption of healthy foods and has been associated with healthy weight maintenance.⁴⁷ Frequent eating may also improve cardiovascular health, including lipids and blood pressure.⁴⁷

The 2015-2020 Dietary Guidelines recommend shifting from high-calorie snacks to nutrient-dense snacks.¹ If individuals with diabetes from the NHANES data set replaced one snack per day for 30 days with a diabetes-specific oral nutritional supplements (ONS), these individuals could reduce their calorie intake by over 5600 calories, carbohydrate intake by 1000 g, and added sugar intake by 500 g, while increasing their protein intake by 196 g.⁴⁸ Similarly, if individuals from the NHANES data set with two chronic health conditions (hypercholesterolemia and/or hypertension and/or obesity), replaced their highest calorie snack per day for 30 days with a lower calorie, lower sugar, higher protein ONS, these individuals could reduce their calorie intake by over 5600 calories, carbohydrate intake by 1100 g, and added sugar intake by 540 g, while adding more than 680 g of protein to their diet.⁴⁸


HOW WE EAT MACRONUTRIENTS

The body uses nutrients for growth, maintenance, and energy. Macronutrients are dietary components needed in large amounts. Macronutrients include protein, fats (lipids), and carbohydrates, which are all sources of energy and serve many metabolic functions.¹ Fiber and water are also considered macronutrients.¹⁸




Proteins are required for tissue maintenance, replacement, function, and growth.¹⁹ Proteins can be broken down during digestion into peptides or amino acids. There are 20 amino acids and nine of them are established as essential, defined as nutrients that must be derived from the diet.¹⁹ Additionally, protein plays a role in regulating postprandial glucose, and high protein intake (>20% of energy from protein) is associated with satiety.²⁰

PROTEINS



Fats are broken down into fatty acids and glycerol and are used by the body for tissue growth, hormone production, and as a source of energy.¹⁹ Fatty acids can be categorized into 3 types: monounsaturated, polyunsaturated, or saturated. Monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs) are found primarily in plant fats.¹⁹ Saturated fats are most commonly found in animal fats. Trans fats are unsaturated and can occur naturally in animal products or can be manufactured by partially hydrogenating unsaturated fats.¹⁹

FATS



Carbohydrates have been characterized as simple or complex, but these terms are associated more with chemical structure and not with physical function. Carbohydrates are comprised of sugars, starches, and most dietary fibers. The digestion of starches and sugars in the small intestine releases glucose and other monosaccharides, which are then absorbed into the blood and supply energy to the body.¹⁹ Additionally, carbohydrates are used as the building blocks for many important molecules, such as DNA. The glycemic index of a carbohydrate represents its ability to increase postprandial blood glucose relative to glucose.²¹ Carbohydrates with a high glycemic index increase plasma glucose rapidly, resulting in exaggerated insulin secretion; the subsequent decline in plasma glucose (below baseline) has been associated with excessive hunger and overeating.²¹ Conversely, carbohydrates with a low glycemic index raise plasma glucose levels slowly, resulting in lower postprandial insulin secretion and may result in a greater feeling of satiety.¹⁹ Fiber is an indigestible carbohydrate and has an indirect role in regulating postprandial glucose and insulin release.¹⁹ It increases gastrointestinal motility, slows gastric emptying, and delays the return of hunger;^{19,22} some dietary fibers have been shown to play a role in enhancing satiety.²³ Furthermore, fiber plays a protective role against heart disease, type 2 diabetes, obesity, Crohn's disease, diverticular disease, constipation, and cancer.^{19,24} Finally, water is required in adequate amounts to support metabolic homeostasis and maintain hydration.¹⁸

CARBOHYDRATES

HOW WE EAT NUTRITION REQUIREMENTS



EATING PATTERNS ARE THE TOTAL FOOD AND BEVERAGE INTAKE THAT MAKE UP AN INDIVIDUAL'S DIETARY INTAKE AND CAN BE TAILORED BASED ON INDIVIDUAL NEEDS AND PREFERENCES.¹

The 2015-2020 Dietary Guidelines for Americans recommend that healthy eating patterns be higher in vegetables, fruits, whole grains, low-fat or nonfat dairy, seafood, legumes, and nuts, and lower in red and processed meat, sugar-sweetened foods and beverages, and refined grains.¹ These guidelines will be updated in 2020 based on the latest evidence from nutrition research.

The Healthy US-style Eating Pattern illustrates daily or weekly amounts for specific food groups that comprise a healthy diet (Table 1).¹

Individuals who wish to maintain weight should strive for energy balance—the balance between energy taken in from food and beverages and energy expended through metabolic processes and physical activity.¹ **It is important to recognize that calorie needs vary based on age, sex, height, weight, life stage (eg, pregnancy or lactation), illness or injury status, and physical activity (Table 2).**

Table 1. Healthy US-style Eating Pattern at 2000-calorie Level¹

Food Group	Amount in the 2,000-Calorie-Level Program
Vegetables	2.5 c-eq/day
Dark Green	1.5 c-eq/wk
Red & Orange	5.5 c-eq/wk
Legumes (Beans & Peas)	1.5 c-eq/wk
Starchy	5 c-eq/wk
Other	4 c-eq/wk
Fruits	2 c-eq/day
Grains	6 oz-eq/day
Whole Grains	≥3 oz-eq/day
Refined Grains	≤3 oz-eq/day
Dairy	3 c-eq/day
Protein Foods	5.5 oz-eq/day
Seafood	8 oz-eq/wk
Meats, Poultry, Eggs	26 oz-eq/wk
Nuts, Seeds, Soy Products	5 oz-eq/wk
Oils	27 g/day
Limit on calories for Other Uses (% of Calories)	270 kcal/day (14%)

HOW WE EAT NUTRITION REQUIREMENTS

Table 2. Estimated Energy Needs (Calories) per Day by Age, Sex, and Physical Activity¹

Age	MALES			FEMALES ^d		
	Sedentary ^a	Moderately Active ^b	Active ^c	Sedentary ^a	Moderately Active ^b	Active ^c
18	2,400	2,800	3,200	1,800	2,000	2,400
19-20	2,600	2,800	3,000	2,000	2,200	2,400
21-25	2,400	2,800	3,000	2,000	2,200	2,400
26-30	2,400	2,600	3,000	1,800	2,000	2,400
31-35	2,400	2,600	3,000	1,800	2,000	2,200
36-40	2,400	2,600	2,800	1,800	2,000	2,200
41-45	2,200	2,600	2,800	1,800	2,000	2,200
46-50	2,200	2,400	2,800	1,800	2,000	2,200
51-55	2,200	2,400	2,800	1,600	1,800	2,200
56-60	2,200	2,400	2,600	1,600	1,800	2,200
61-65	2,000	2,400	2,600	1,600	1,800	2,000
66-70	2,000	2,200	2,600	1,600	1,800	2,000
71-75	2,000	2,200	2,600	1,600	1,800	2,000

^a Only the physical activity of independent living.

^b Physical activity equivalent to walking about 1.5 to 3 miles per day at 3 to 4 miles per hour, in addition to the activities of independent living.

^c Physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour, in addition to the activities of independent living.

^d Estimates for females do not include women who are pregnant or breastfeeding.
 c, cups; eq, equivalents; g, grams; wk, week.

HOW WE EAT WHERE TO START

SMALL CHANGES BIG RESULTS

The benefits of good nutrition are clear. Diets high in fruits and vegetables are associated with a reduced risk of chronic diseases, while diets high in whole grains are associated with reduced cardiovascular disease risk and lower body weight.¹ Dairy products are linked to improved bone health,¹ while fish, seafood, and nuts are associated with a lower risk of fatal coronary heart disease

events.⁷ Good nutrition is also important to maintain muscle mass and strength, which is especially important among older individuals.¹⁰ And yet, only a small fraction of Americans are achieving proper nutrition.^{1,7,26} This widespread prevalence of poor nutrition, in combination

with the challenges associated with managing chronic conditions, further complicated by the limited time available to spend with patients, leaves healthcare providers feeling overwhelmed.

Barriers commonly prevent individuals from achieving adequate nutrition. Individuals with limited health literacy may not understand dietary information and nutrition labels, resulting in poorer nutrition quality,²⁷ however, the most common barriers to adequate nutrition go far beyond knowledge barriers. Reported barriers to good nutrition include a lack of time, the higher cost of healthy food, difficulty in adjusting dietary habits, food access, food insecurity, and challenges in avoiding unhealthy food in social environments.^{1,28,29}

Healthcare providers often view a person's unwillingness to change as a key barrier.³⁰ Healthcare providers believe that individuals are responsible for changing their behaviors but also believe they are unwilling to make the necessary changes, which results in provider frustration. Consequently, healthcare providers tend to neglect

counseling interventions and instead rely on pharmacotherapy.³⁰ Less than one-third of individuals seen by a healthcare provider receive nutrition counseling,³¹ and among adults with nutrition-related chronic disease, less than 45% receive nutrition counseling.²⁵ However, brief nutrition counseling can be effective,³² and efforts to establish trust with patients

leads to improved adherence to healthy lifestyle behaviors.³³ Simple, face-to-face education and counseling has been shown to increase fruit and vegetable intake, especially in individuals with pre-existing health conditions.³⁴ Behavior-based interventions to promote healthy eating can reduce the incidence of diabetes and lower cholesterol, blood pressure, glucose, and body weight.³⁵ Even adults who are simply given advice by their healthcare provider are more likely to change their eating habits.³⁶ The International Food Information Council reported in their 2018 Food & Health Survey that 78% of individuals who received nutrition information from a healthcare professional made a change to their eating as a result of those conversations.³⁷



Food insecurity affects **48 million Americans** and makes choosing healthy foods challenging.¹ Furthermore, individuals with food insecurity adopt snacking as a strategy to skip meals, so they often eat snacks without hunger and consequently consume more calories.²⁹



Initiate the conversation & assess readiness to change



Provide education and identify barriers to change



Encourage patients to commit to small changes

HOW WE EAT WHERE TO START

SMALL CHANGES **BIG RESULTS** (CONTINUED)

Making changes to eating patterns is challenging but attainable. **Healthcare providers must have realistic expectations of individuals who make lifestyle changes as an idealistic stance leads clinicians to perceive total failure, even when significant lifestyle changes have been made.**³⁰ According to the 2015-2020 Dietary Guidelines for Americans, “small shifts in food choices— over the course of a week, a day, or even a meal—can make a difference.”¹ While people estimate that they make 15 food-related decisions per day, the reality is that they make more than 200.³⁸ Thus, individuals have 200 opportunities each day to make healthier food choices. This allows individuals and healthcare providers to take a step-wise approach to improving dietary habits.

The 2015-2020 Dietary Guidelines for Americans recommend that healthcare providers emphasize that “every food choice is an opportunity to move toward a healthy eating pattern.”¹

For instance, Americans are consuming a large portion of their calories through snacks laden with refined grains and added sugars. **A simple switch to nutrient-dense snacks that provide better nutrition and enhance satiety is a realistic and small shift that can help individuals start adopting healthier patterns.**¹ The 2015-2020 Dietary Guidelines for Americans further state that, for certain individuals, “fortified foods and dietary supplements may be useful in providing one or more nutrients that otherwise may be consumed in less than recommended amounts.” For example, in individuals with diabetes, ONS can improve postprandial plasma glucose and time to peak insulin response by providing nutrition that is lower in carbohydrates and sugar.³⁹ In fact, breakfast replacement for three months with a diabetes-specific ONS containing low-glycemic carbohydrates reduces the area under the curve of postprandial glucose excursions in individuals with type 2 diabetes.⁴⁰ Individuals with nutritional complexities who are at high risk for malnutrition can experience a significant reduction in weight loss when consuming nutrient-dense, high-protein ONS.⁴¹ Furthermore, in the malnourished elderly, complete and balanced ONS (nutrient dense, high protein, high calorie) significantly improves nutritional status, nutrition-related complications, weight, body mass index, emotional functioning, and days spent in bed.^{42,43} There are a variety of populations who are at risk for or suffer from poor nutrition, and in these individuals, ONS may offer a convenient and effective option to improve nutritional status. ■

“EVERY FOOD CHOICE IS AN OPPORTUNITY TO MOVE TOWARD A HEALTHY EATING PATTERN.”¹

CONCLUSION

The current state of nutrition in America is a public health crisis that is substantially affecting the health of our population and the costs associated with caring for the consequent chronic diseases. Nutrition intervention is critical, and while it certainly benefits individuals, it is estimated that adoption of a healthier diet among Americans could create \$114.5 billion/year in savings from direct and indirect medical costs, increased productivity, and the value of prolonged life.⁴⁴ Given the high prevalence of poor nutrition and the challenges associated with behavior change interventions, enacting change may seem like a daunting task. But, it is important to remember that even small changes make a difference and can lead individuals to adopt healthier patterns.

REFERENCES

- US Department of Health and Human Services; US Department of Agriculture. 2015-2020 Dietary Guidelines for Americans. 8th ed. Washington, DC: US Dept of Health and Human Services; December 2015. Available at: https://health.gov/dietaryguidelines/2015/resources/2015-2020_Dietary_Guidelines.pdf. Accessed March 27, 2019.
- Murray CJ, Atkinson C, Bhalla K, et al. The state of US health, 1990-2010: burden of diseases, injuries, and risk factors. *JAMA*. 2013;310:591-608.
- Reedy J, Lerman JL, Krebs-Smith SM, et al. Evaluation of the Healthy Eating Index-2015. *J Acad Nutr Diet*. 2018;118:1622-1633.
- Mozaffarian D, Benjamin EJ, Go AS, et al. Heart disease and stroke statistics—2015 update: a report from the American Heart Association. *Circulation*. 2015;131:e29-e322.
- Micha R, Peñalvo JL, Cudhea F, Imamura F, Rehm CD, Mozaffarian D. Association between dietary factors and mortality from heart disease, stroke, and type 2 diabetes in the United States. *JAMA*. 2017;317:912-924.
- Centers for Disease Control and Prevention. Nutrition, Physical Activity, and Obesity: Keeping Americans Healthy at Every Stage Life. At a Glance 2016. Available at: <https://www.cdc.gov/chronicdisease/resources/publications/aag/dnpao.htm>. Accessed March 27, 2019.
- Benjamin EJ, Virani SS, Callaway CW, et al. Heart disease and stroke statistics-2018 update: A report from the American Heart Association. *Circulation*. 2018;137:e67-e492.
- Rehm CD, Peñalvo JL, Afshin A, Mozaffarian D. Dietary intake among US adults, 1999-2012. *JAMA*. 2016;315:2542-2553.
- Berryman CE, Lieberman HR, Fulgoni VL 3rd, Pasiakos SM. Protein intake trends and conformity with the Dietary Reference Intakes in the United States: analysis of the National Health and Nutrition Examination Survey, 2001-2014. *Am J Clin Nutr*. 2018;108:405-413.
- Krok-Schoen JL, Archdeacon Price A, Luo M, Kelly OJ, Taylor CA. Low dietary protein intakes and associated dietary patterns and functional limitations in an aging population: A NHANES analysis. *J Nutr Health Aging*. 2019;1-10.
- Imamura F, Micha R, Khatibzadeh S, et al. Dietary quality among men and women in 187 countries in 1990 and 2010: a systematic assessment. *Lancet Glob Heal*. 2015;3:e132-e142.
- MacLean RR, Cowan A, Vernarelli JA. More to gain: dietary energy density is related to smoking status in US adults. *BMC Public Health*. 2018;18:365.
- Evans C. Malnutrition in the elderly: a multifactorial failure to thrive. *Perm J*. 2005;9:38-41.
- Krok-Schoen J, Kelly O, Luo M, Taylor C. Differences in Overall Diet Quality across Age Groups and Diabetes Status in US Adults [abstract]. In: Aging in America Conference; 2018 Mar 26-29; San Francisco, CA.
- Piernas C, Popkin BM. Snacking Increased among U.S. Adults between 1977 and 2006. *J Nutr*. 2010;140:325-332.
- Dunford EK, Poti JM, Popkin BM. Emerging disparities in dietary sodium intake from snacking in the US population. *Nutrients*. 2017;9:1-12.
- Taylor C, Krok-Schoen J, Kelly O, Luo M. New Evidence That Snack Calories are the Lowest Quality Calories for People with Diabetes [abstract]. In: ASPEN Nutrition Science & Practice Conference; 2018 Jan 22-25; Las Vegas, NV.
- United States Department of Agriculture. Macronutrients: Food and Nutrition Information Center. Available at: <https://www.nal.usda.gov/fnic/macronutrients>. Accessed March 27, 2019.
- Yodanis A. Overview of Nutrition. In: Merck Manuals Professional Edition. Merck Sharp & Dohme Corp., a subsidiary of Merck & Co., Inc., 2016. <https://www.merckmanuals.com/professional/nutritional-disorders/nutrition-general-considerations/overview-of-nutrition>. Accessed March 27, 2019.
- Yang D, Liu Z, Yang H, Jue Y. Acute effects of high-protein versus normal-protein isocaloric meals on satiety and ghrelin. *Eur J Nutr*. 2014;53:493-500.
- Augustin LS, Kendall CW, Jenkins DJ, et al. Glycemic index, glycemic load and glycemic response: An International Scientific Consensus Summit from the International Carbohydrate Quality Consortium (ICQC). *Nutr Metab Cardiovasc Dis*. 2015;25:795-815.
- Benini L, Castellani G, Brighenti F, et al. Gastric emptying of a solid meal is accelerated by the removal of dietary fibre naturally present in food. *Gut*. 1995;36:825-830.
- Clark MJ, Slavin JL. The effect of fiber on satiety and food intake: A systematic review. *J Am Coll Nutr*. 2013;32:200-211.
- Harvard T.H. Chan School of Public Health. The Nutrition Source: Fiber. Available at: <https://www.hsph.harvard.edu/nutritionsource/carbohydrates/fiber/>. Accessed March 27, 2019.
- Institute of Medicine (US) Food and Nutrition Board. What Are Dietary Reference Intakes? Dietary Reference Intakes. Washington DC: National Academies Press; 1998. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK45182/>. Accessed March 27, 2019.
- Basiotis PP, Carlson A, Gerrier SA, Juan W, Lino M. The Healthy Eating Index, 1999-2000. Available at: https://www.cnpp.usda.gov/sites/default/files/healthy_eating_index/HEI99-00report.pdf. Accessed March 27, 2019.
- Kuczmarksi MF, Adams EL, Cotugno N, et al. Health literacy and education predict nutrient quality of diet of socioeconomically diverse, urban adults. *J Epidemiol Prev Med*. 2016;2:1-16.
- Seguin R, Connor L, Nelson M, LaCroix A, Eldridge G. Understanding barriers and facilitators to healthy eating and active living in rural communities. *J Nutr Metab*. 2014;2014:146502.
- Zizza CA, Duffy PA, Gerrier SA. Food insecurity is not associated with lower energy intakes. *Obesity*. 2008;16:1908-1913.
- Jallinoja P, Absetz P, Kuronen R, et al. The dilemma of patient responsibility for lifestyle change: perceptions among primary care physicians and nurses. *Scand J Prim Health Care*. 2007;25:244-249.
- Ahmed NU, Delgado M, Saxena A. Trends and disparities in the prevalence of physicians' counseling on diet and nutrition among the U.S. adult population, 2000-2011. *Prev Med*. 2016;89:70-75.
- Whatnall MC, Patterson AJ, Ashton NL, Hutcheson MJ. Effectiveness of brief nutrition interventions on dietary behaviours in adults: A systematic review. *Appetite*. 2018;120:335-347.
- Jones DE, Carson KA, Bleich SN, Cooper LA. Patient trust in physicians and adoption of lifestyle behaviors to control high blood pressure. *Patient Educ Couns*. 2012;89:57-62.
- Pomerleau J, Lock K, Knai C, McKee M. Interventions designed to increase adult fruit and vegetable intake can be effective: A systematic review of the literature. *J Nutr*. 2005;135:2486-2495.
- Kanaya AM. Review: Diet and exercise counseling improve intermediate health outcomes in persons with CV risk factors. *Ann Intern Med*. 2014;161:JC7.
- Viera AJ, Kshirsagar A V, Hinderliter AL. Lifestyle modifications to lower or control high blood pressure: is advice associated with action? The behavioral risk factor surveillance survey. *J Clin Hypertens* (Greenwich). 2008;10:105-111.
- International Food Information Council Foundation. 2018 Food & Health Survey. Available at: <https://foodinsight.org/wp-content/uploads/2018/05/2018-FHS-Report-FINAL.pdf>. Accessed March 27, 2019.
- Wansink B, Sobal J. Mindless eating: The 200 daily food decisions we overlook. *Environ Behav*. 2007;39:106-123.
- Wang W-Q, Zhang Y-F, Zhou D-J, et al. Open-label, randomized, multiple-center, parallel study comparing glycemic responses and safety profiles of Glucerna versus Fresubin in subjects of type 2 diabetes mellitus. *Endocrine*. 2008;33:45-52.
- Stenvers DJ, Schouten LJ, Jurgens J, et al. Breakfast replacement with a low-glycaemic response liquid formula in patients with type 2 diabetes: a randomised clinical trial. *Br J Nutr*. 2014;112:504-512.
- Lee H, Havrila C, Bravo V, et al. Effect of oral nutritional supplementation on weight loss and percutaneous endoscopic gastrostomy tube rates in patients treated with radiotherapy for oropharyngeal carcinoma. *Support Care Cancer*. 2008;16:285-289.
- Payette H, Boutier V, Coulombe C, Gray-Donald K. Benefits of nutritional supplementation in free-living, frail, undernourished elderly people: A prospective randomized community trial. *J Am Diet Assoc*. 2002;102:1088-1095.
- Ordóñez J, De Antonio Veira JA, Pou Soler C, et al. [Effect of an oral hyperproteic nutritional supplement in malnourished elderly patients in nursing homes]. *Nutr Hosp*. 2010;25:549-554.
- Anekwe TD, Rahkovsky I. Economic costs and benefits of healthy eating. *Curr Obes Rep*. 2013;2:225-234.
- Kerver JM, Yang EJ, Obayashi S, Bianchi L, Song WO. Meal and snack patterns are associated with dietary intake of energy and nutrients in US adults. *J Am Diet Assoc*. 2006;106:46-53.
- Capaldi ED, Owens JQ, Privitera GJ. Isocaloric meal and snack foods differentially affect eating behavior. *Appetite*. 2006;46:117-123.
- Hess JM, Jonnalagadda SS, Slavin JL. What is a snack, why do we snack, and how can we choose better snacks? A review of the definitions of snacking, motivations to snack, contributions to dietary intake, and recommendations for improvement. *Adv Nutr*. 2016;7:466-475.
- Abbott, data on file.

Glucerna and Ensure are registered trademarks of Abbott Laboratories.