The Future of Food as Medicine: Addressing Food & Nutrition Security in Community Health

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Learning Objectives

1

Describe the relationship between food insecurity, nutrition security, and chronic disease outcomes in vulnerable populations.

2

Examine the role of ultra-processed foods and dietary quality in driving cardiometabolic disease and health disparities.

3

Identify practical Food as Medicine strategies that Community Health Centers can implement to improve patient outcomes and address nutrition-related social needs.

The Rockefeller Foundation reports ***$1.1 Trillion dollars of Health Care costs are attributed to poor nutrition and diet-related disease each year.”***

The State of US Health, 1990-2016: Burden of Diseases, Injuries, and Risk Factors Among US States

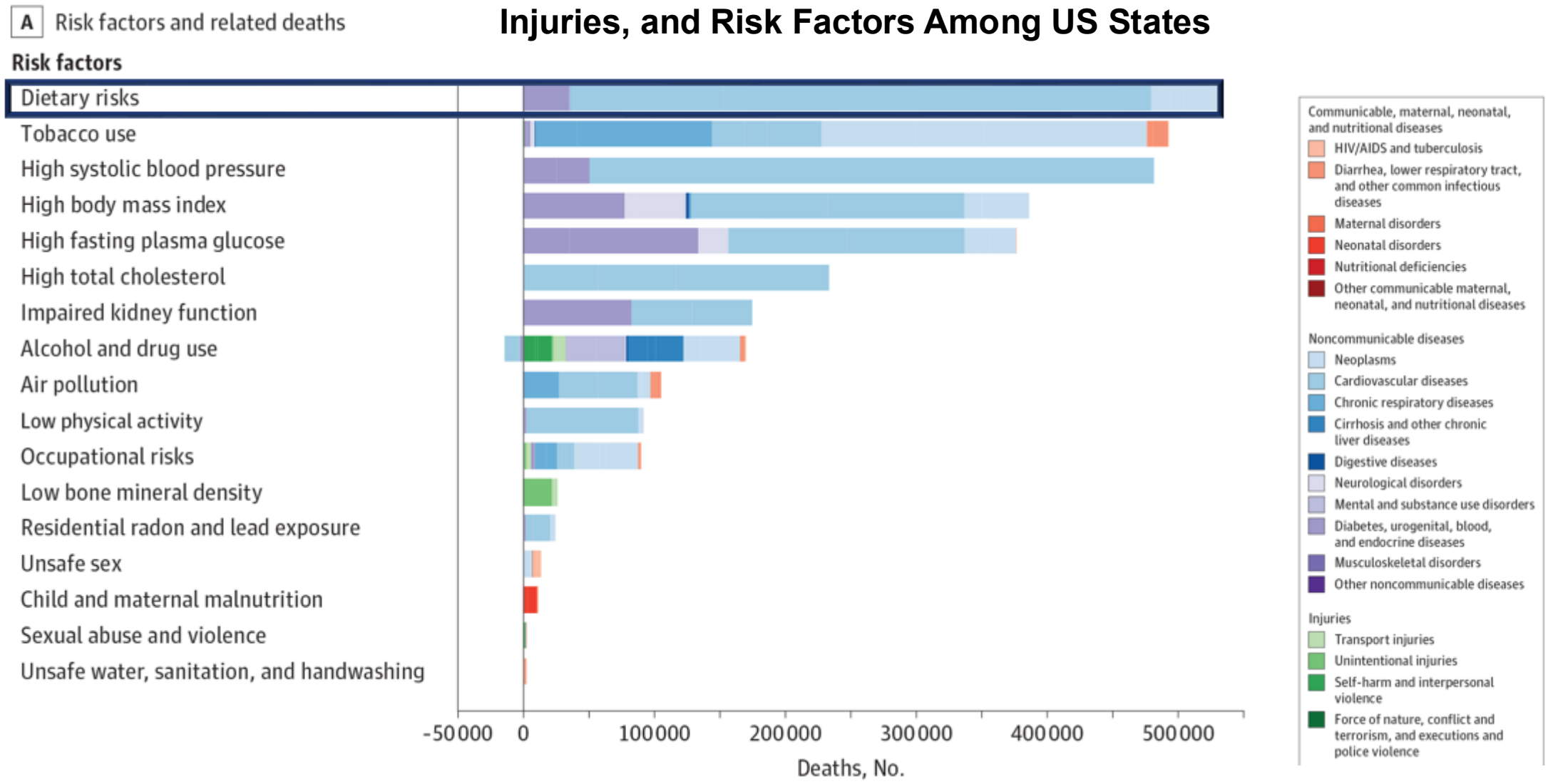

Figure: Number of Deaths and Percentage of Disability-Adjusted Life-Years Related to the 17 Leading Risk Factors in the United States, 2016

REPORT

A Review of Current Guidelines for the Treatment of Obesity

Marc-André Cornier, MD

Introduction

In 2013, the American Medical Association (AMA) designated obesity as a chronic disease.[1] In 2014, the American College of Cardiology (ACC), the American Heart Association (AHA), and The Obesity Society (TOS) published clinical practice guidelines for the management of overweight and obesity in adults.[2] In 2016, the American Association of Clinical Endocrinologists (AACE) and American College of Endocrinology (ACE) published evidence-based clinical practice guidelines that built upon the AMA's designation, the AACE's novel diagnostic paradigm that incorporated both body mass index (BMI) and weight-related complications, and the AACE's framework that suggested that weight-related complications rather than a universal weight-loss target determine treatment modality selection.[3] These 2 comprehensive documents remain the most accepted guidelines for the treatment of obesity.

However, much has changed since the development of these 2 guidelines. After the critical questions of the ACC/AHA/TOS guideline were chosen and before the AACE/ACE guidelines were published, the FDA approved 4 new medications for the long-term treatment of obesity.[4–7] Further, since publication of the AACE/ACE guidelines, another long-term anti-obesity medication (AOM) was approved, an AOM was withdrawn from the market, and several procedures and device types for weight loss and weight management were recommended or FDA-approved.[4,8–11] These guidelines remain cornerstones for treatment for obesity. However, since their publication, input from the Centers for Disease Control and Prevention and several professional organizations—including the Endocrine Society, the National Institute of Diabetes and Digestive and Kidney Diseases, the American Society for Metabolic & Bariatric Surgery (ASMBS), the Obesity Medicine Association, and the American Society of Anesthesiologists—have advanced our understanding of the disease.[12–15]

This article summarizes and synthesizes the 2013 ACC/AHA/TOS guideline and the 2016 AACE/ACE guidelines and supplements that foundation with recent guidance from the aforementioned organizations. It also highlights consensus that obesity is a serious, progressive, and chronic disease.[12–15]

ABSTRACT

Two guidelines—one by the American College of Cardiology (ACC)/American Heart Association (AHA)/The Obesity Society (TOS), and the other by the American Association of Clinical Endocrinologists (AACE)/American College of Endocrinology (ACE)—remain the standard of care in the management of overweight and obesity in adults. However, since the publication of the ACC/AHA/TOS document, several relevant pharmacotherapies have been approved by the FDA, a medication was withdrawn from the market, and several procedures and device types for weight loss have been recommended or FDA-approved. Simultaneously, research in obesity treatment has advanced, and leaders in the field have issued complementary guidance. This article summarizes and synthesizes the 2013 ACC/AHA/TOS and the 2016 AACE/ACE guidelines and includes updates from more recent professional association guidance. Measurement of body mass index is recommended to initiate evaluation for overweight and obesity and determine disease classification. To stage disease severity, weight-related conditions should be assessed. Although lifestyle therapy remains the cornerstone of treatment for this disease, both pharmacotherapy and metabolic and bariatric surgery produce greater and more sustained weight loss in treatment-approved populations as compared with lifestyle modifications alone. An ongoing partnership between the patient and clinician is highly recommended to manage this serious, progressive, chronic disease.

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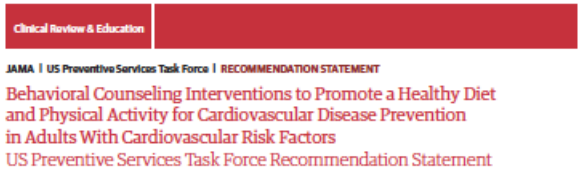
For author information and disclosures, see end of text.


Clinical Review & Education

JAMA | US Preventive Services Task Force | RECOMMENDATION STATEMENT

Behavioral Counseling Interventions to Promote a Healthy Diet and Physical Activity for Cardiovascular Disease Prevention in Adults With Cardiovascular Risk Factors

US Preventive Services Task Force Recommendation Statement

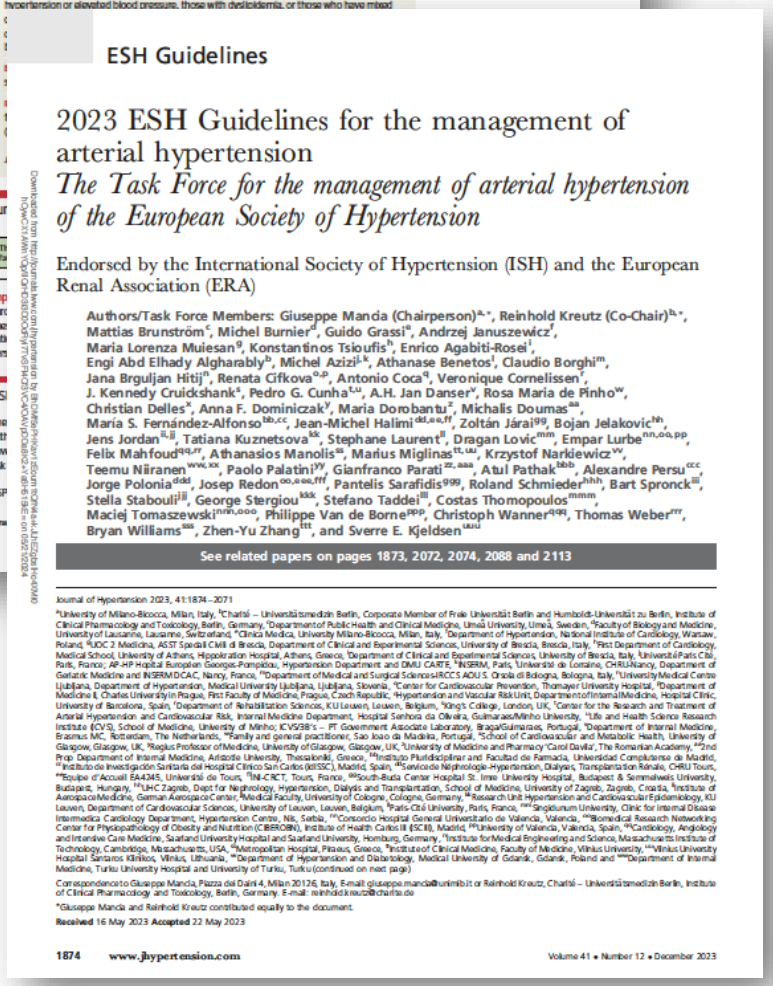
US Preventive Services Task Force

IMPORTANCE Cardiovascular disease (CVD) is a leading cause of death in the US. Known modifiable risk factors for CVD include smoking, overweight and obesity, diabetes, elevated blood pressure or hypertension, dyslipidemia, lack of physical activity, and unhealthy diet. Adults who adhere to national guidelines for a healthy diet and physical activity have lower cardiovascular morbidity and mortality than those who do not. All persons, regardless of their CVD risk status, benefit from healthy eating behaviors and appropriate physical activity.

OBJECTIVE To update its 2014 recommendation, the USPSTF commissioned a review of the evidence on behavioral counseling to promote a healthy diet and physical activity for CVD prevention in adults with cardiovascular risk factors.

POPULATION This recommendation statement applies to adults 18 years or older with known hypertension or elevated blood pressure, those with dyslipidemia, or those who have mixed

Editorial page 2036
Author Audio Interview
Related article page 2076 and JAMA Patient Page page 2114
Supplemental content
Related article at jamanetworkopen.com


ESH Guidelines

2023 ESH Guidelines for the management of arterial hypertension

The Task Force for the management of arterial hypertension of the European Society of Hypertension

Endorsed by the International Society of Hypertension (ISH) and the European Renal Association (ERA)

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See related papers on pages 1873, 2072, 2074, 2088 and 2113

Journal of Hypertension 2023, 41:1874–2071

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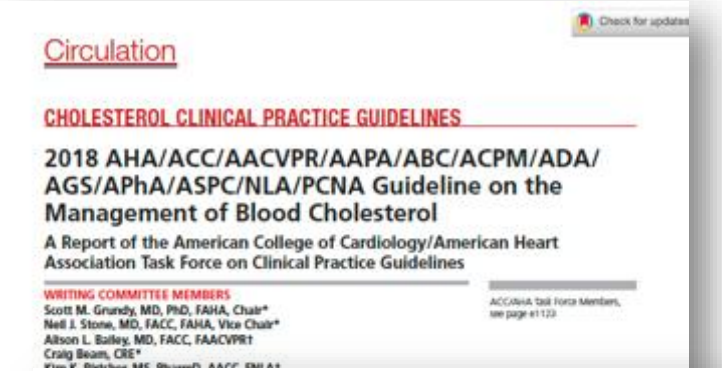
Circulation

CHOLESTEROL CLINICAL PRACTICE GUIDELINES

2018 AHA/ACC/AACVPR/AAPA/ABC/ACPM/ADA/AGS/APhA/ASPC/NLA/PCNA Guideline on the Management of Blood Cholesterol

A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines

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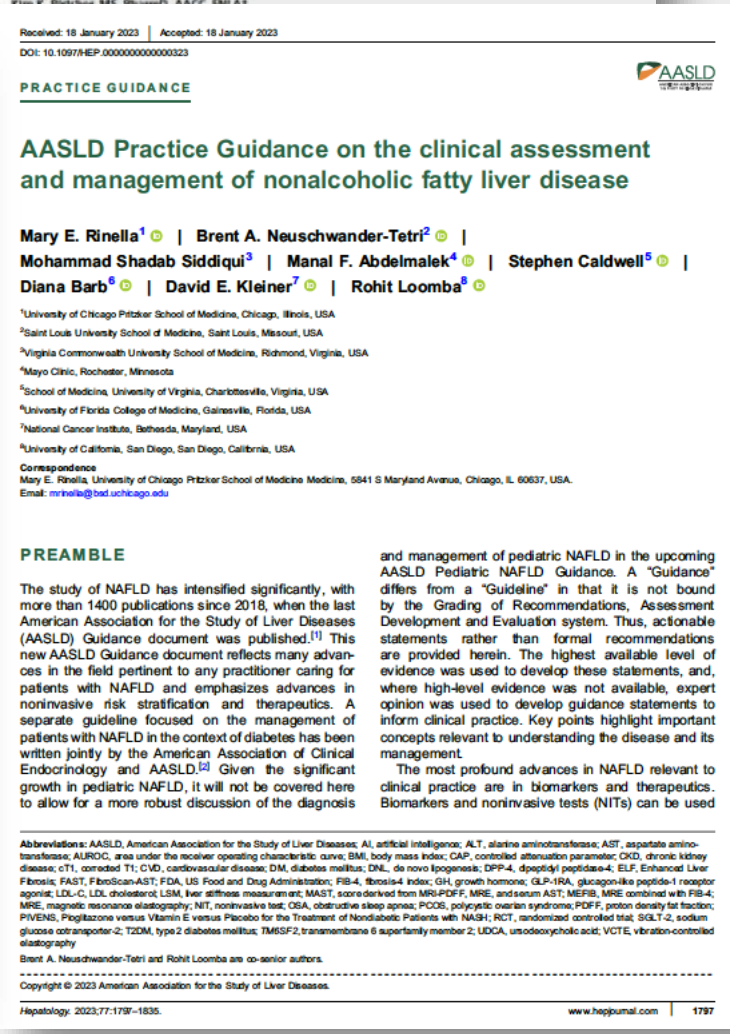
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PRACTICE GUIDANCE

AASLD Practice Guidance on the clinical assessment and management of nonalcoholic fatty liver disease

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PREAMBLE

The study of NAFLD has intensified significantly, with more than 1400 publications since 2018, when the last American Association for the Study of Liver Diseases (AASLD) Guidance document was published.[1] This new AASLD Guidance document reflects many advances in the field pertinent to any practitioner caring for patients with NAFLD and emphasizes advances in noninvasive risk stratification and therapeutics. A separate guideline focused on the management of patients with NAFLD in the context of diabetes has been written jointly by the American Association of Clinical Endocrinology and AASLD.[2] Given the significant growth in pediatric NAFLD, it will not be covered here to allow for a more robust discussion of the diagnosis and management of pediatric NAFLD in the upcoming AASLD Pediatric NAFLD Guidance. A "Guidance" differs from a "Guideline" in that it is not bound by the Grading of Recommendations, Assessment Development and Evaluation system. Thus, actionable statements rather than formal recommendations are provided herein. The highest available level of evidence was used to develop these statements, and, where high-level evidence was not available, expert opinion was used to develop guidance statements to inform clinical practice. Key points highlight important concepts relevant to understanding the disease and its management.

The most profound advances in NAFLD relevant to clinical practice are in biomarkers and therapeutics. Biomarkers and noninvasive tests (NITs) can be used

Abbreviations: AASLD, American Association for the Study of Liver Diseases; AI, artificial intelligence; ALT, alanine aminotransferase; AST, aspartate aminotransferase; AUROC, area under the receiver operating characteristic curve; BMI, body mass index; CAP, controlled attenuation parameter; CKD, chronic kidney disease; cT1, corrected T1; CVD, cardiovascular disease; DM, diabetes mellitus; DNL, de novo lipogenesis; DPP-4, dipeptidyl peptidase-4; ELF, Enhanced Liver Fibrosis; FAST, FibroScan-AST; FDA, US Food and Drug Administration; FIB-4, fibrosis-4 index; GH, growth hormone; GLP-1RA, glucagon-like peptide-1 receptor agonist; LDL-C, LDL cholesterol; LSM, liver stiffness measurement; MAST, score derived from MRI-PDFF, MRE, and serum AST; MEFIB, MRE combined with FIB-4; MRE, magnetic resonance elastography; NIT, noninvasive test; OSA, obstructive sleep apnea; PCOS, polycystic ovarian syndrome; PDFF, proton density fat fraction; PIVENS, Pioglitazone versus Vitamin E versus Placebo for the Treatment of Nondiabetic Patients with NASH; RCT, randomized controlled trial; SGLT-2, sodium glucose cotransporter-2; T2DM, type 2 diabetes mellitus; *TM6SF2*, transmembrane 6 superfamily member 2; UDCA, ursodeoxycholic acid; VCTE, vibration-controlled elastography

Brent A. Neuschwander-Tetri and Rohit Loomba are co-senior authors.

Food as Medicine

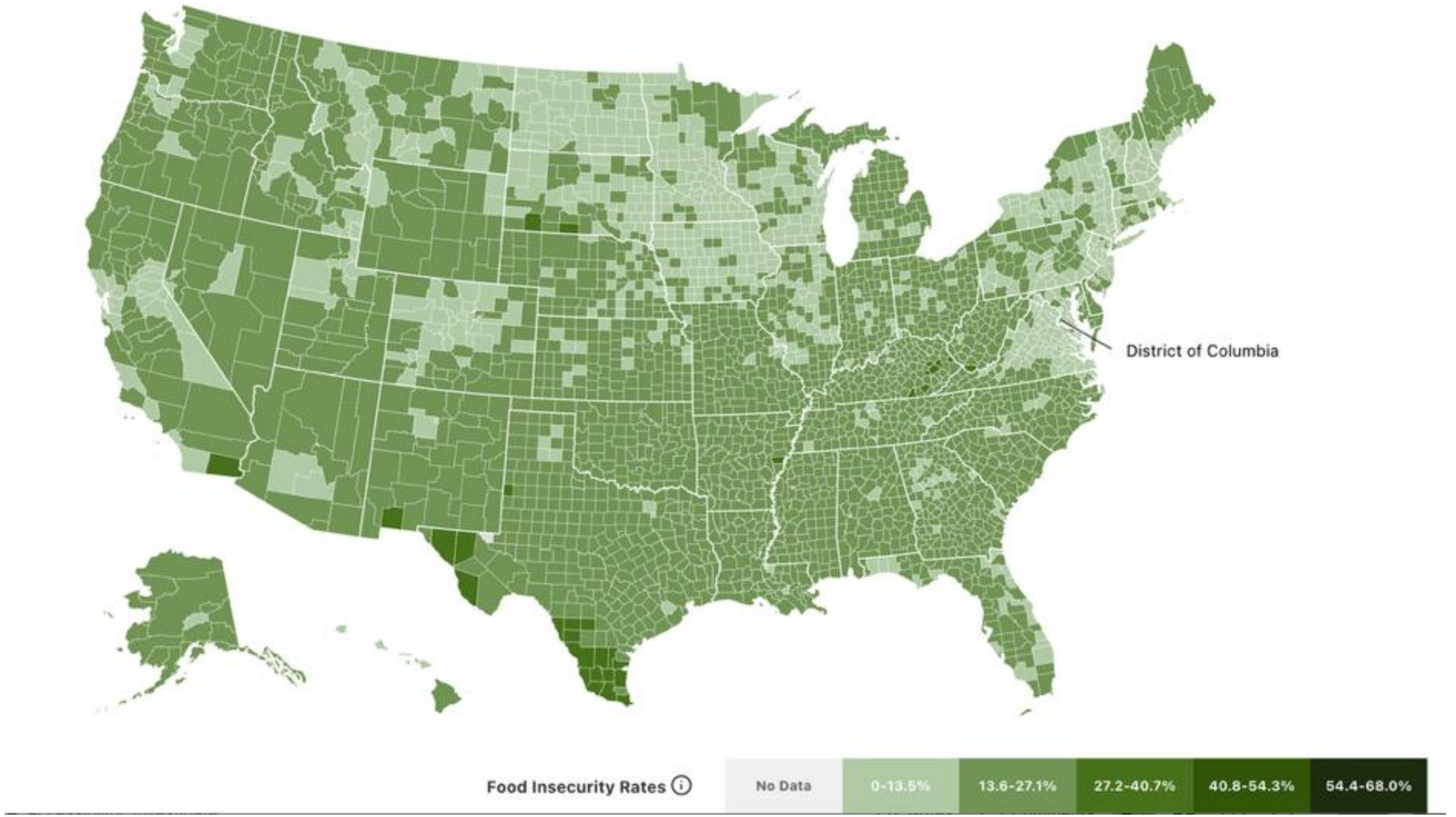
Food as Medicine

Food as medicine consists of the strategies and interventions that work as part of healthcare to improve access to nutritious food to prevent, manage, or even treat disease.

Fueled by our bold purpose to improve the health of humanity, we are transforming from a traditional health benefits organization into a lifetime trusted health partner.

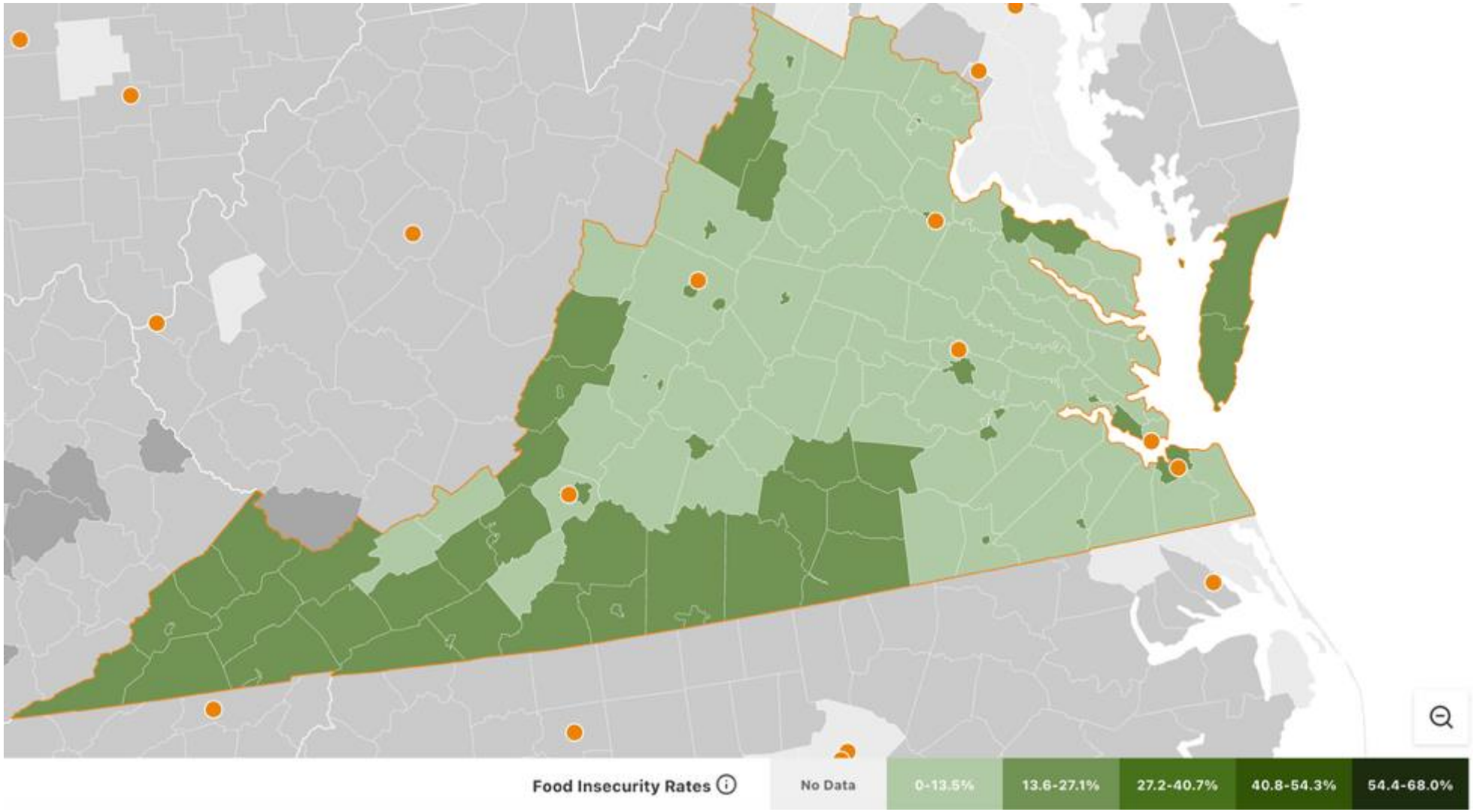
Our nearly 100,000 associates serve approximately 109 million people, at every stage of health. We address a full range of needs with an integrated whole health approach, powered by industry-leading capabilities and a digital platform for health.

U.S. Food Insecurity Prevalence



Map the Gap, Feeding America, 2023

Virginia Food Insecurity Prevalence



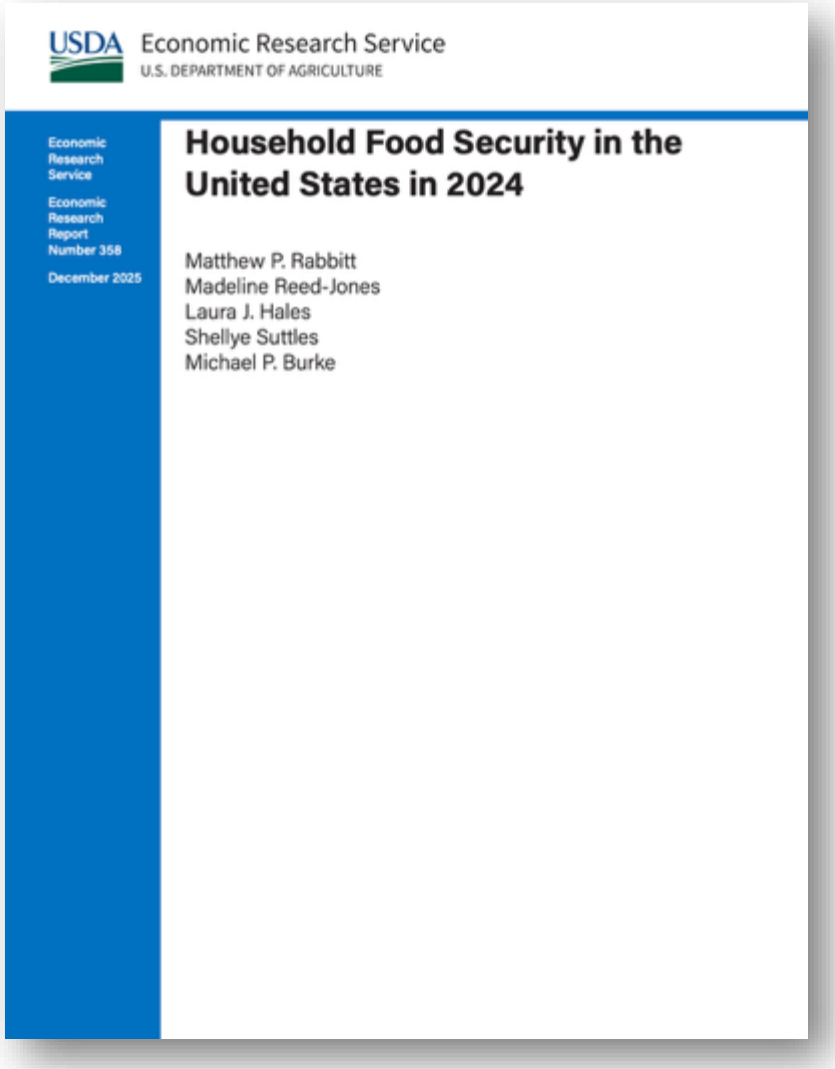
Map the Gap, Feeding America, 2024

Food Insecurity

The limited or uncertain availability of nutritionally adequate and safe foods, or limited, or uncertain ability to acquire acceptable foods in socially acceptable ways.[1]

- **13.7% of the population** lives in Food Insecure Households.
- Black/Hispanic families have **2-3x higher rates** than White families.
- Nationally, Food insecurity is associated with **higher risk of cardiometabolic disease**.

Disease	Food Insecurity	Food Security	P - Value
Diabetes	**19.5%**	11.5%	P<.0001
Hypertension	**14.1%**	11.1%	P=.0003
Coronary Heart Disease	**20.5%**	11.9%	P<.001
Congestive Heart Failure	**18.4%**	12.1%	P=.004
Obesity	**14.3%**	11.1%	P<.001



1 Core Indicators of Nutritional State for Difficult to Sample Populations, 1990; 2 Gupta, et. al, Frontiers in Nutrition, 2019; 3 USDA, 2024; 4 Berkowitz, et. Al, 2017, 5. Menichetti, et. Al, 2023, 6. USDA DGA

Household Lived Experiences

Experience of Members Without Food as Medicine Strategy

Maria is a 45 yo working mother with uncontrolled diabetes, recent experiences with food/nutrition insecurity and three children aged 13, 6, & 4. Maria oscillates back and forth between Private insurance and Medicaid and has had increased financial hardships due to decreased hours at work. Currently living with 72yo mother on Medicare Advantage with recent hospitalization due to fall.

Food Anxiety

Basic anxiety or worry about food. Preoccupation with access to enough food.

Monotony of Diet

Decrease in Nutritional Quality, Variety, and/or Desirability of diet

Adult Intake Decreases

Food shortage experienced and adults decrease intake

Child Intake Decreases

Food intake of children decreases, and adults access foods in "socially uncomfortable" ways

Decrease in Quality → **Decrease in Quantity**

Story is not actual patient but taken from real life common scenario.

Essel, et. Al, Springer, 2018

Stress & Types of Food Consumption

- Hyperpalatable & More Pleasurable Foods
- Increased Fat & Sugar
- More disinhibited/binge eating behaviors

Ultra-processed Foods

ELSEVIER

Physiology & Behavior 91 (2007) 449–458

PHYSIOLOGY & BEHAVIOR

Stress, eating and the reward system

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Abstract

An increasing number of people report concerns about the amount of stress in their life. At the same time obesity is an escalating health problem worldwide. Evidence is accumulating rapidly that stress related chronic stimulation of the hypothalamic–pituitary–adrenal (HPA) axis and resulting excess glucocorticoid exposure may play a potential role in the development of visceral obesity. Since adequate regulation of energy and food intake under stress is important for survival, it is not surprising that the HPA axis is not only the "conductor" of an appropriate stress response, but is also tightly intertwined with the endocrine regulation of appetite. Here we attempt to link animal and human literatures to tease apart how different types of psychological stress affect eating. We propose a theoretical model of Reward Based Stress Eating. This model emphasizes the role of cortisol and reward circuitry on motivating calorically dense food intake, and elucidating potential neuroendocrine mediators in the relationship between stress and eating. The addiction literature suggests that the brain reward circuitry may be a key player in

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Stress and Eating Behaviors

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Abstract

Obesity is a heterogeneous construct that, despite multiple and diverse attempts, has been difficult to treat. One conceptualization gaining media and research attention in recent years is that foods, particularly hyperpalatable (e.g., high-fat, high sugar) ones, may possess addictive qualities. Stress is an important factor in the development of addiction and in addiction relapse, and may contribute to an increased risk for obesity and other metabolic diseases. Uncontrollable stress changes eating patterns and the salience and consumption of hyperpalatable foods; over time, this could lead to changes in allostatic load and trigger neurobiological adaptations that promote increasingly compulsively behavior. This association may be mediated by alterations in the hypothalamic-pituitary-adrenal (HPA) axis, glucose metabolism, insulin sensitivity, and other appetite-related hormones and hypothalamic neuropeptides. At a neurocircuitry level, chronic stress may affect the mesolimbic dopaminergic system and other brain regions involved in stress/motivation circuits. Together, these may synergistically potentiate reward sensitivity, food preference, and the wanting and seeking of hyperpalatable foods, as well as induce metabolic changes that promote weight and body fat mass. Individual differences in susceptibility to obesity and types of stressors may further moderate this process. Understanding the associations and interactions between stress, neurobiological adaptations, and obesity is important in the development of effective prevention and treatment strategies for obesity and related metabolic diseases.

Keywords

Obesity; Food Addiction; Stress; HPA axis; Mesolimbic Dopaminergic System

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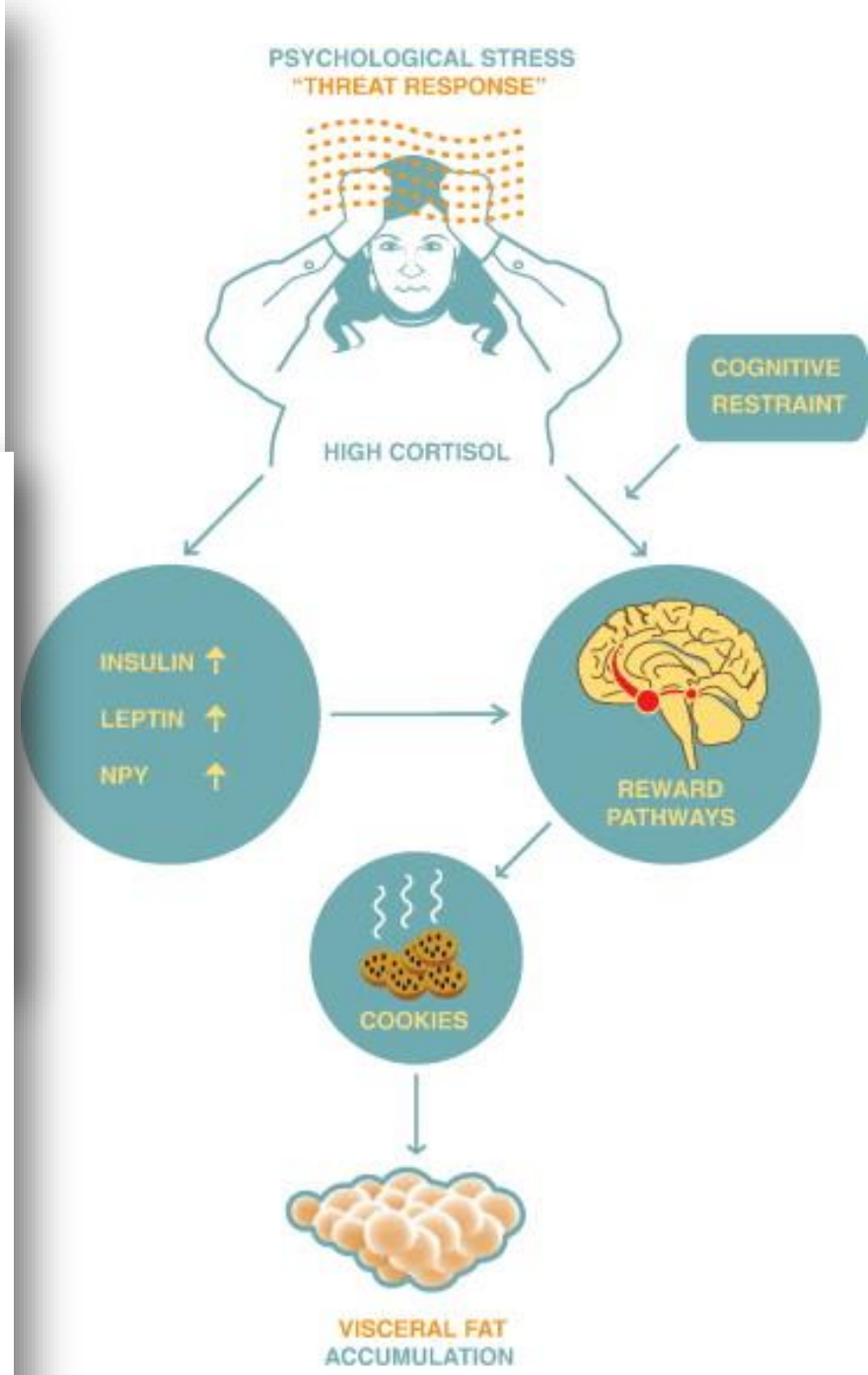
CONFLICT OF INTEREST

The authors report no conflicts of interest with respect to the content of this manuscript. Dr. Potenza has consulted for Lundbeck and Ironwood pharmaceuticals, has had financial interests in Somaxon pharmaceuticals, received research support from Mohegan Sun Casino, Psyadon pharmaceuticals, the National Center for Responsible Gambling, the National Institutes of Health (NIH), Veterans Administration, has participated in surveys, mailings, or telephone consultations related to drug addiction, impulse-control disorders, or other health topics, has consulted for gambling, legal and governmental entities on issues related to addictions or impulse-control disorders, has provided clinical care in the Connecticut Department of Mental Health and Addiction Services Problem Gambling Services Program, has performed grant reviews for the NIH and other agencies, has guest edited journal sections, has given academic lectures in grand rounds, Continuing Medical Education events, and other clinical or scientific venues, and has generated books or book chapters for publishers of mental health texts. Yvonne Yau reports no disclosures.



Dietary Guidelines For Americans

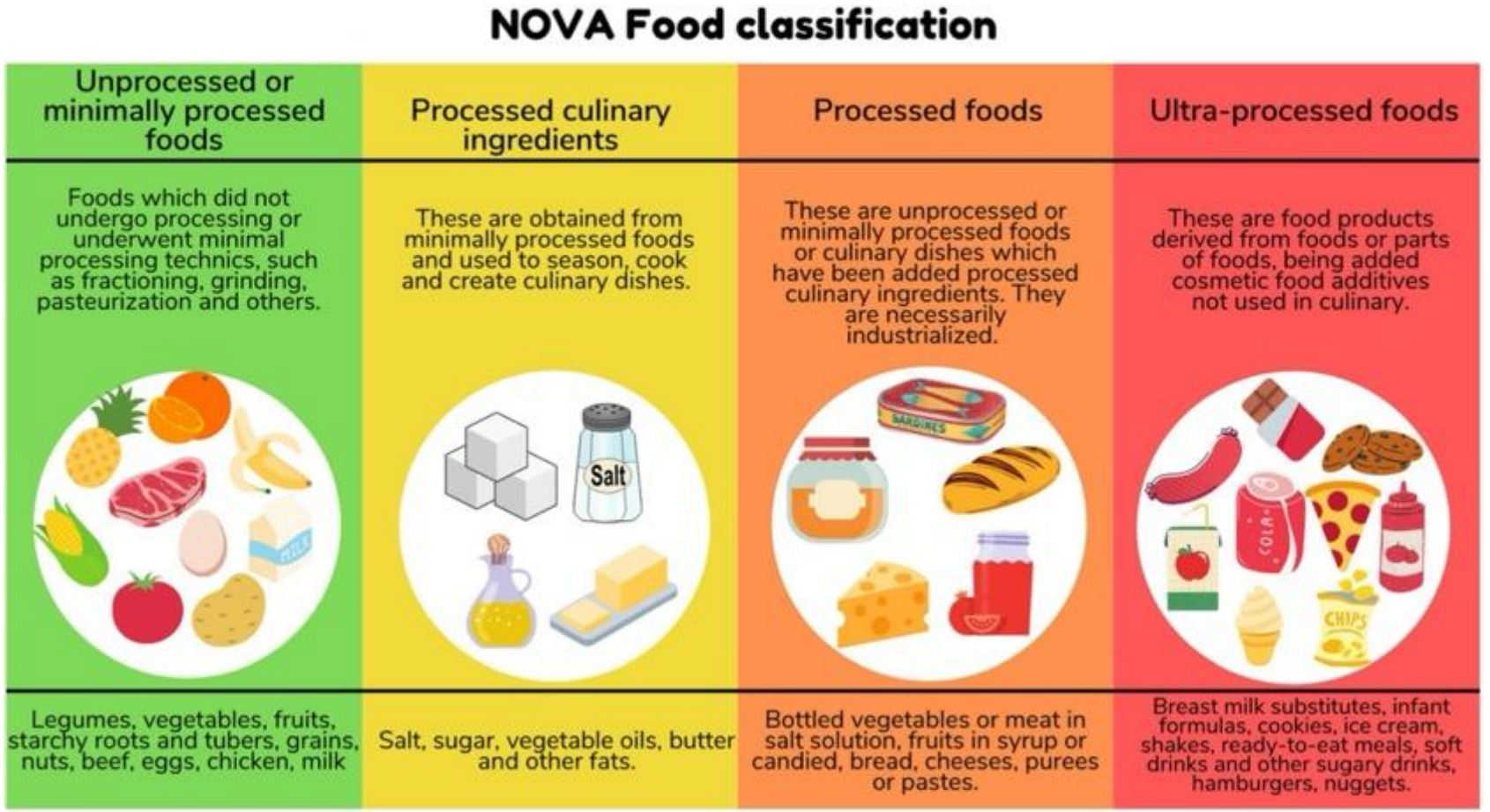
USDA

realfood.gov

2025–2030

NOVA Food Classification

1. Unprocessed or minimally processed foods
2. Processed culinary ingredients
3. Processed foods
4. Ultra-processed foods



Most of our food intake (>55%) is ultra-processed foods!

De Oliveira, PG, et. Al, Front Nutr, 2022

Foods classified as ultra-processed are those that have many added ingredients such as artificial coloring, added sugars, emulsifiers and preservatives. An apple may undergo minimal processing when it gets made into applesauce. But when it gets made into a shelf-stable apple pie or candy gummies with added sugars, colorings and flavorings, these foods are considered ultra-processed.

Meredith Rizzo for NPR

LIVING BETTER

What we know about the health risks of ultra-processed foods

MAY 25, 2023 · 12:05 PM ET

HEARD ON ALL THINGS CONSIDERED

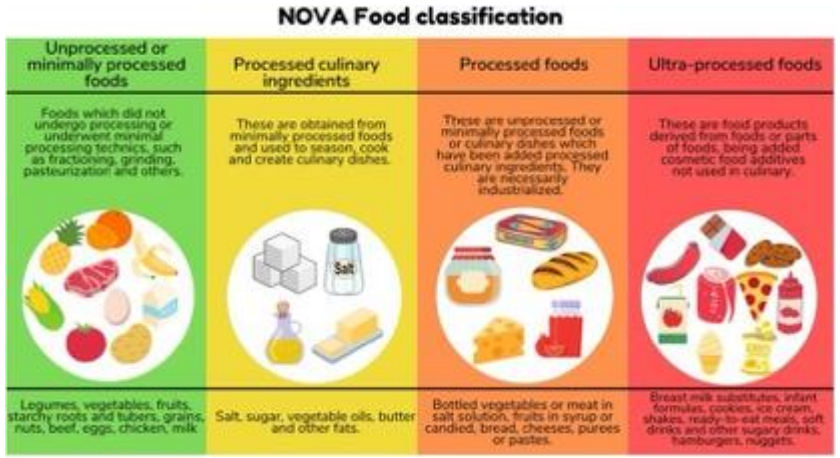
Maria Godoy

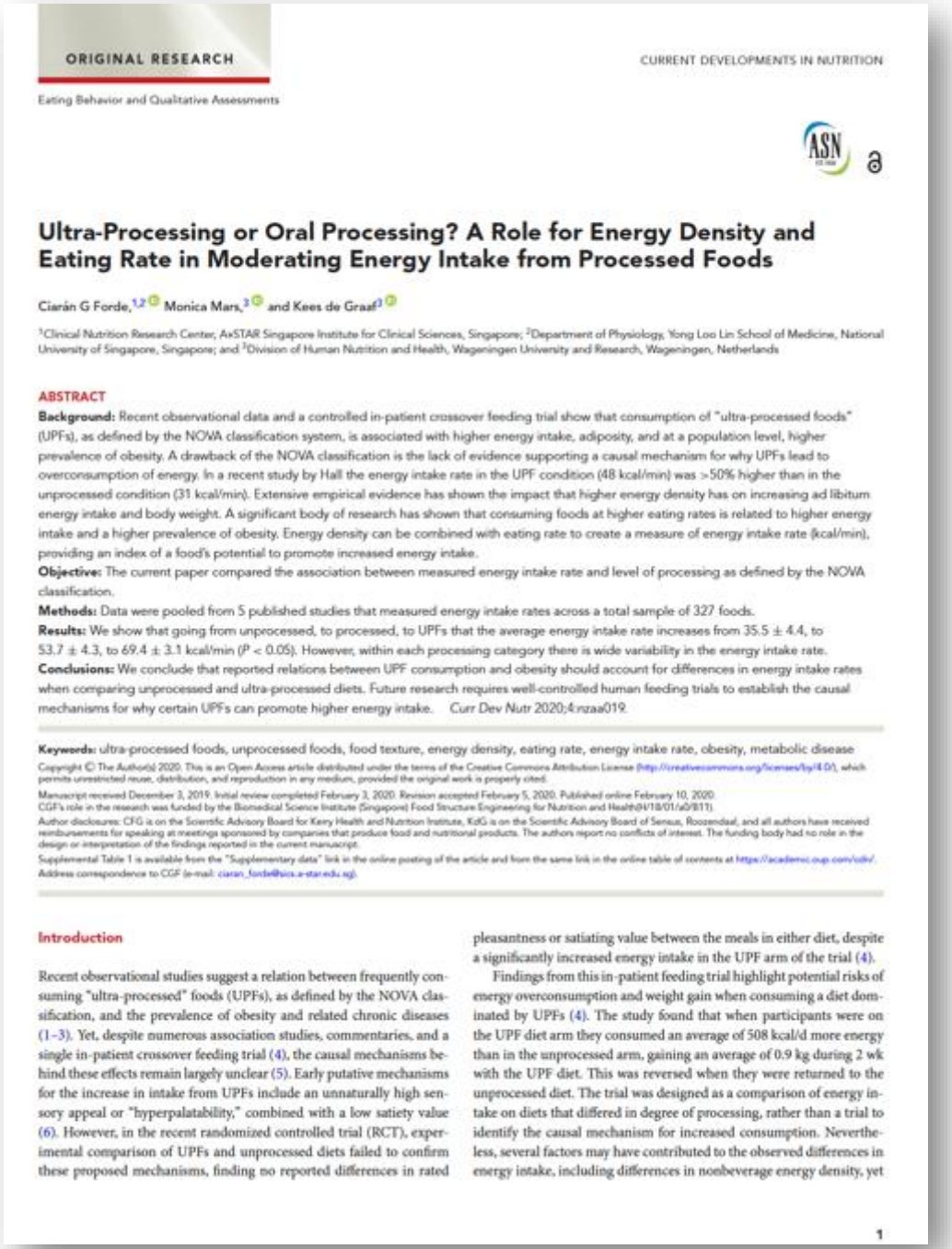
8-Minute Listen + PLAYLIST

Ultra-processed foods & Eating Speed

An analysis of 327 foods found that the average energy intake rate for foods:

Category of Food	Speed of Eating
Category #1: Unprocessed/Minimally processed foods	35.5 kcal/min
Category #3: Processed Foods	53.7 kcal/min
Category #4: Ultra-processed Foods	69.4 kcal/min





ORIGINAL RESEARCH

Eating Behavior and Qualitative Assessments

CURRENT DEVELOPMENTS IN NUTRITION

Ultra-Processing or Oral Processing? A Role for Energy Density and Eating Rate in Moderating Energy Intake from Processed Foods

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ABSTRACT

Background: Recent observational data and a controlled in-patient crossover feeding trial show that consumption of "ultra-processed foods" (UPFs), as defined by the NOVA classification system, is associated with higher energy intake, adiposity, and at a population level, higher prevalence of obesity. A drawback of the NOVA classification is the lack of evidence supporting a causal mechanism for why UPFs lead to overconsumption of energy. In a recent study by Hall the energy intake rate in the UPF condition (48 kcal/min) was >50% higher than in the unprocessed condition (31 kcal/min). Extensive empirical evidence has shown the impact that higher energy density has on increasing ad libitum energy intake and body weight. A significant body of research has shown that consuming foods at higher eating rates is related to higher energy intake and a higher prevalence of obesity. Energy density can be combined with eating rate to create a measure of energy intake rate (kcal/min), providing an index of a food's potential to promote increased energy intake.

Objective: The current paper compared the association between measured energy intake rate and level of processing as defined by the NOVA classification.

Methods: Data were pooled from 5 published studies that measured energy intake rates across a total sample of 327 foods.

Results: We show that going from unprocessed, to processed, to UPFs that the average energy intake rate increases from 35.5 ± 4.4, to 53.7 ± 4.3, to 69.4 ± 3.1 kcal/min ($P < 0.05$). However, within each processing category there is wide variability in the energy intake rate.

Conclusions: We conclude that reported relations between UPF consumption and obesity should account for differences in energy intake rates when comparing unprocessed and ultra-processed diets. Future research requires well-controlled human feeding trials to establish the causal mechanisms for why certain UPFs can promote higher energy intake. *Curr Dev Nutr* 2020;4:nzaa019.

Keywords: ultra-processed foods, unprocessed foods, food texture, energy density, eating rate, energy intake rate, obesity, metabolic disease

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Supplemental Table 1 is available from the "Supplementary data" link in the online posting of the article and from the same link in the online table of contents at https://academic.oup.com/cdn/.

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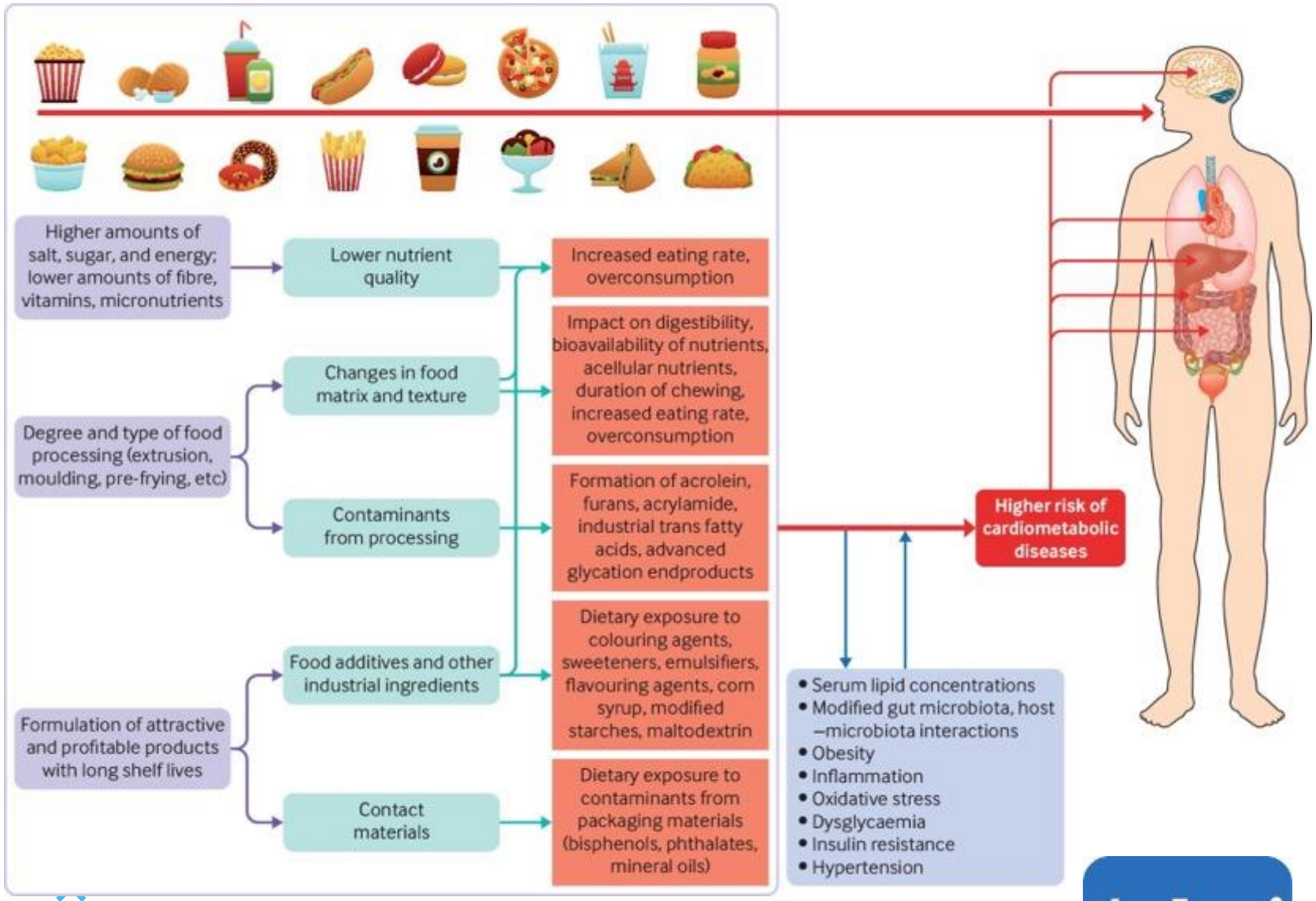
Introduction

Recent observational studies suggest a relation between frequently consuming "ultra-processed" foods (UPFs), as defined by the NOVA classification, and the prevalence of obesity and related chronic diseases (1–3). Yet, despite numerous association studies, commentaries, and a single in-patient crossover feeding trial (4), the causal mechanisms behind these effects remain largely unclear (5). Early putative mechanisms for the increase in intake from UPFs include an unnaturally high sensory appeal or "hyperpalatability," combined with a low satiety value (6). However, in the recent randomized controlled trial (RCT), experimental comparison of UPFs and unprocessed diets failed to confirm these proposed mechanisms, finding no reported differences in rated pleasantness or satiating value between the meals in either diet, despite a significantly increased energy intake in the UPF arm of the trial (4).

Findings from this in-patient feeding trial highlight potential risks of energy overconsumption and weight gain when consuming a diet dominated by UPFs (4). The study found that when participants were on the UPF diet arm they consumed an average of 508 kcal/d more energy than in the unprocessed arm, gaining an average of 0.9 kg during 2 wk with the UPF diet. This was reversed when they were returned to the unprocessed diet. The trial was designed as a comparison of energy intake on diets that differed in degree of processing, rather than a trial to identify the causal mechanism for increased consumption. Nevertheless, several factors may have contributed to the observed differences in energy intake, including differences in nonbeverage energy density, yet

De Oliveira, PG, et. Al, Front Nutr, 2022; Williams, et. al, NCHS Data Brief, 2025

Summary of potential factors and mechanisms linking ultra-processed food consumption with adverse cardiometabolic outcomes.



FOOD FOR THOUGHT 2023

Ultra-processed foods and cardiometabolic health: public health policies to reduce consumption cannot wait

Incomplete understanding of the multiple mechanisms underlying the link between ultra-processed foods and cardiometabolic health should not be an excuse for inaction argue **Mathilde Touvier and colleagues**

The effect of diet on health has historically been considered from a nutrient based perspective—for example, excess total fat, saturated fat, dietary cholesterol, calories, sugar, or salt and lack of dietary fibre, vitamins, and minerals.[1] More recently, this approach has been complemented by extensive evidence supporting health effects of dietary patterns (eg, the Mediterranean diet), characterised by various dietary scores such as the Alternative Healthy Eating Index (AHEI), or DASH (Dietary Approaches to Stop Hypertension) diet.[2] However, the degree of processing and formulation of foods was not taken into account. For instance, all vegetable soups were considered similar, regardless of whether they were homemade, industrial canned, or industrial dehydrated and contained food additives and flavours.

The potential health effect of food processing and food formulation, beyond their food ingredients, nutrient composition, and energy content, is now being widely researched. An important milestone was the 2009 publication of the NOVA classification,[3] which categorises foods according to the type, intensity, and purpose of food processing (box 1). The ultra-processed group includes all foods and drinks made using intense physical or chemical processes or containing cosmetic food additives and other industrial ingredients (eg, artificial flavours, hydrogenated oils, glucose/fructose corn syrup).[4] These foods are generally convenient, affordable, highly palatable, and often intensively advertised.

Prospective studies since 2015 have encompassing a wide variety of products and ingredients that may have different effects on health. Although evidence is emerging about the mechanisms whereby ultra-processed foods and their components affect human health, much remains to be unravelled. Given the economic interest in the ultra-processed foods market, some big food companies are advocating for no public action in the meantime, including attempts to conflate the benefits of food processing (such as greater shelf stability, microbiological safety, affordability, and attractive functional and taste properties of foods) with ultra-processing, and promoting a view that there is no or only limited consensus about the relation between food processing and human health.[5 6]

However, we believe that the available evidence justifies certain public health measures to reduce population level exposure. These should be implemented in synergy with measures promoting foods and diets that are minimally processed

KEY MESSAGES

- Mounting evidence from epidemiological studies links consumption of ultra-processed food to poorer cardiometabolic health
- Factors at play (eg, food ingredient profiles, additive mixtures, process or

May increase risk for:

1. Type 2 Diabetes
2. Hypertension
3. Overweight/Obesity
4. Cardiovascular and Cerebrovascular events
5. All cause death
6. Several cancers
7. Depression
8. Inflammatory bowel disease
9. Gestational Diabetes
10. Etc

Mathilde Touvier et al. BMJ 2023;383:bmj-2023-075294

REVIEW

The Role of the Gut Microbiota in Dietary Interventions for Depression and Anxiety

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ABSTRACT

There is emerging evidence that an unhealthy dietary pattern may increase the risk of developing depression or anxiety, whereas a healthy dietary pattern may decrease it. This nascent research suggests that dietary interventions could help prevent, or be an alternative or adjunct therapy for, depression and anxiety. The relation, however, is complex, affected by many confounding variables, and is also likely to be bidirectional, with dietary choices being affected by stress and depression. This complexity is reflected in the data, with sometimes conflicting results among studies. As the research evolves, all characteristics of the relation need to be considered to ensure that we obtain a full understanding, which can potentially be translated into clinical practice. A parallel and fast-growing body of research shows that the gut microbiota is linked with the brain in a bidirectional relation, commonly termed the microbiome–gut–brain axis. Preclinical evidence suggests that this axis plays a key role in the regulation of brain function and behavior. In this review we discuss possible reasons for the conflicting results in diet–mood research, and present examples of areas of the diet–mood relation in which the gut microbiota is likely to be involved, potentially explaining some of the conflicting results from diet and depression studies. We argue that because diet is one of the most significant factors that affects human gut microbiota structure and function, nutritional intervention studies need to consider the gut microbiota as an essential piece of the puzzle. *Adv Nutr* 2020;11:890–907.

Keywords: microbiome–gut–brain axis, depression, anxiety, mood, mental health, nutritional psychiatry, microbiota, diet, nutrition

Introduction

Around 15–20% of people will experience mental health disorders such as a depressive episode or anxiety disorder in their lifetime (1, 2), and anxiety and depression are ranked in the top 10 causes of the global burden of disease (3, 4). Unfortunately, our understanding of these disorders and ability to effectively treat them are poor; for example ~30%–40% of those with depression do not adequately respond to pharmacological or psychological treatment (5). The high impact on individual quality of life, as well as on the public health system, means that preventing and treating anxiety and depression is a global priority. Consequently, there has been a call for a broader research approach with more interdisciplinary efforts (6, 7). Recent approaches in depression and anxiety research are investigating *1*) the links between diet and mood, and *2*) the influence of gut microbiota on neurobiology and behavior, termed the microbiome–gut–brain axis (MGBA). There is emerging evidence showing a strong influence of both diet and gut microbiota on emotional behavior and neurological processes, and because the gut microbiota is strongly affected by diet (8), these 2 factors are also intertwined (**Figure 1**). With increasing understanding of the mechanisms involved in the complex interplay between diet and the gut microbiome and its impact on anxiety/depression, specific dietary patterns that can help prevent anxiety and mood disorders can be identified. In addition, the use of dietary intervention may prove to be an attractive and cost-effective alternative or adjuvant therapy to clinically treat these disorders. This review discusses the reasons for conflicting research on the link between diet and depression, and how any diet and depression relation is likely to be influenced by changes in the MGBA. The focus of the review is on whole diets and, and although interactions of the gut microbiota with individual components of the diet are discussed, separate dietary supplements (such as probiotics) are not included in detail.

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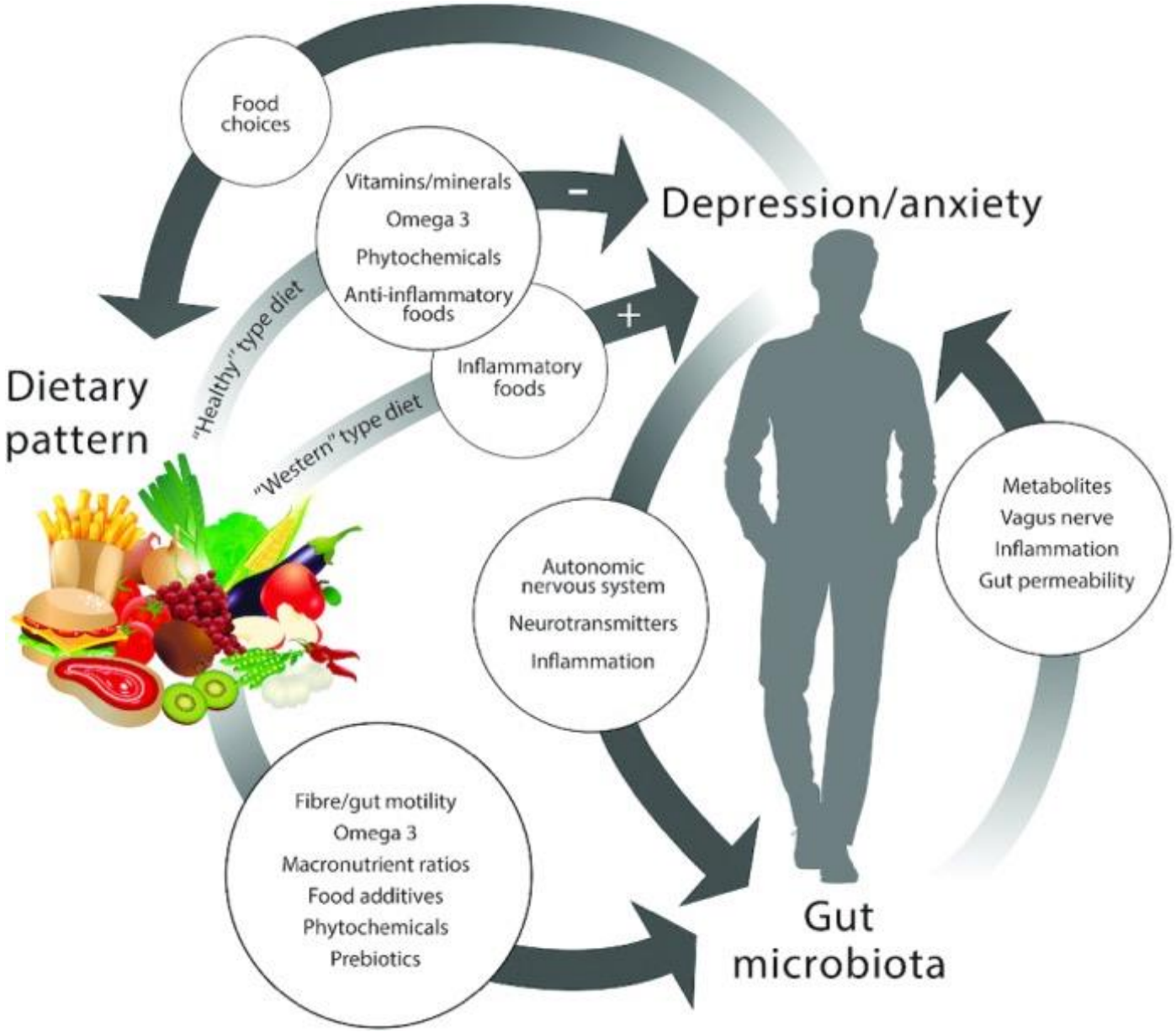
Address correspondence to TLKB (e-mail: traceybear@hotmail.co.nz).
Abbreviations used: AA, arachidonic acid; FA, fatty acid; FFAR, free fatty acid receptor; FODMAP, Fermentable Oligosaccharides, Disaccharides, Monosaccharides, And Polyols; FOS, fructooligosaccharide; GABA, γ-aminobutyric acid; GF, germ-free; GOS, galactooligosaccharide; HFD, high-fat diet; HPA, hypothalamic–pituitary–adrenal; MGBA, microbiome–gut–brain axis; POX, polydextrose; SPF, specific pathogen–free.

 Adv Nutr 2020;11:890–907; doi: https://doi.org/10.1093/advances/nmaa016.



Bear, T., Dalziel, J., Adv Nutr., 2020

FAM must prioritize high quality foods through Nutrition Insecurity as a Complement to Food Insecurity

Food Insecurity

The limited or uncertain availability of nutritionally adequate and safe foods, or limited, or uncertain ability to acquire acceptable foods in socially acceptable ways.[1]

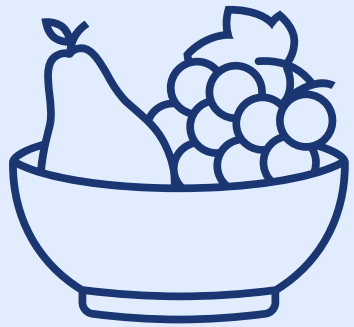
- **13.7% of the population** lives in Food Insecure Households.
- Black/Hispanic families have **2-3x higher rates** than White families.
- Nationally, Food insecurity is associated with **higher risk of cardiometabolic disease**.

Disease	Food Insecurity	Food Security	P - Value
Diabetes	**19.5%**	11.5%	P<.0001
Hypertension	**14.1%**	11.1%	P=.0003
Coronary Heart Disease	**20.5%**	11.9%	P<.001
Congestive Heart Failure	**18.4%**	12.1%	P=.004
Obesity	**14.3%**	11.1%	P<.001

Nutrition Insecurity

The lack of "consistent and equitable access to healthy, safe, affordable foods essential to optimal health and well-being." [3]
Prioritizes high quality foods.

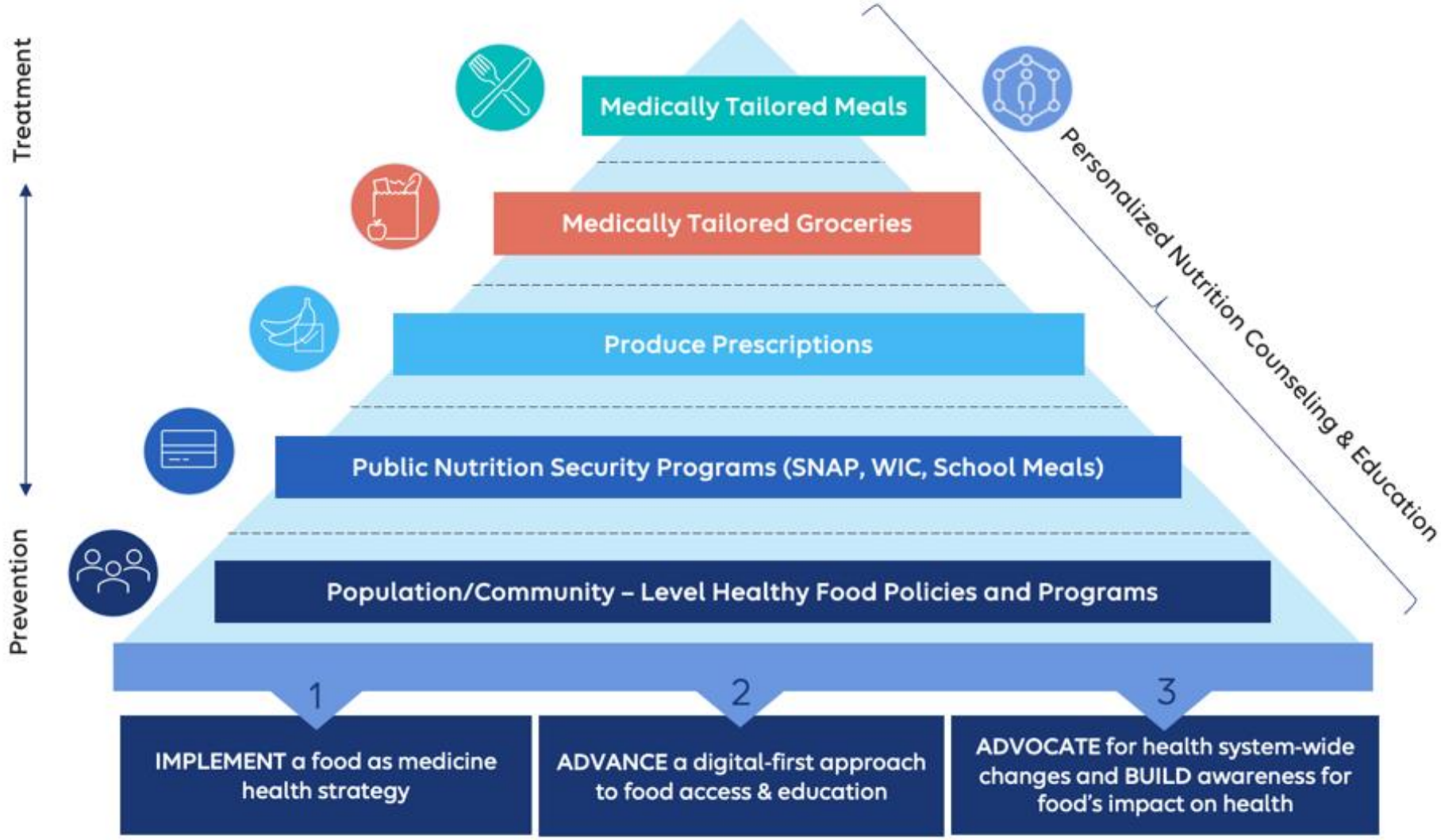
- **73 percent of the U.S. food supply is ultra-processed**[5]
- **>55% of caloric intake** in the US comes from ultra-processed food.[2]
- **9 in 10** Adults do NOT consume enough fruits/vegetables



1 Core Indicators of Nutritional State for Difficult to Sample Populations, 1990; 2 Williams, et. al, NCHS Data Brief, 2025; 3 USDA, 2024; 4 Berkowitz, et. Al, 2017, 5. Menichetti, et. Al, 2023, 6. USDA DGA

Elevance Health's Food as Medicine Approach

Food as Medicine Pyramid



Adapted from the Massachusetts Food Is Medicine State Plan, The Center for Health Law and Policy Innovation of Harvard Law School and Community Servings, June 2019

Food as Medicine Community Health Center Landscape

Background to NACHC Survey supported by Elevance Health Foundation

"Let food be thy medicine and medicine be thy food," -- Hippocrates

Survey Objectives

Assess the F4H Landscape: Understand current adoption, care delivery models, and reach across Community Health Centers

Identify Barriers & Enablers: Examine the workforce, infrastructure, financing, and partnerships that influence implementation and sustainability

Define Opportunities to Scale: Identify the supports, investments, and policy opportunities needed to expand sustainable F4H programs

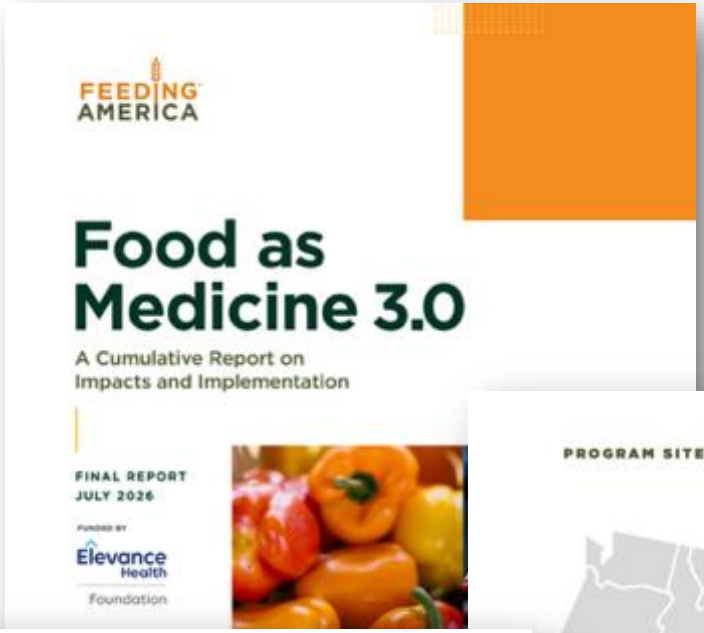
NACHC conducted a nationwide survey to obtain a comprehensive view of how CHC's identify food and nutrition needs and respond through Food for Health (F4H) strategies.

Survey was disseminated between January- March 2026.

A total of 285 CHC's responded representing a 19% response rate. 61% in Urban Areas; 39% in Rural Areas

65% of CHC's reported offering at least one F4H-related program, reflecting a robust sample of active participants.

Elevance Health Foundation Feeding America Grant



Key findings:

- Hospitalization rates fell by 14% and emergency department visits dropped by 11%
- Blood sugar, weight, and cholesterol levels improved among participants who received nutrition education
- Food security and nutrition security improved alongside consistent access to nutritious foods, including fruits and vegetables
- Participants emphasized the importance of dignity, choice, and flexibility in program delivery

https://www.feedingamerica.org/sites/default/files/2026-07/FAM3_FA_Cumulative_Report_Final.pdf

Elevance Health Foundation & VCHA Partnership to Support Food as Medicine in Community Health Centers

VIRGINIA COMMUNITY HEALTHCARE ASSOCIATION

ADVOCATE™
EDUCATE
ELEVATE

Practical Strategies for Health Centers

10 Things You Can Do When You Get back to your CHC

01
Start by Listening
Ask patients what would help.

02
Start Small, But Start
You don't need a perfect program to begin.

03
Find Your Community Partners
Food banks, pantries, grocers, farmers, gardens.

04
Universally Screen & Intervene
Make food insecurity screening routine, then act on it.

05
Measure What Matters
Track quantitative outcomes plus patient stories(qualitative).

06
Leverage Existing Programs
Complement, don't replace, federal programs. Look into VCHA programs.

07
Learn From Others
Use NACHC practices; connect with VCHA peers.

08
Build a Food as Medicine Culture
Educate your entire team.

09
Build for Sustainability
Think beyond the pilot.

10
Remember: You Are Not Alone
Build a peer network; we learn faster together.

Our Commitment

We will use food as medicine approaches in everything we do, from prevention to treatment. We will use digital tools to improve access to food and nutrition, leverage thought leadership and advocacy to help improve related health system support and offer education opportunities to help people learn more about how food can affect health.

THANK YOU!

Elevance Health