PLANT POWERHOUSES

FOR HAPPIER, HEALTHIER LIVES

Presented by
Taylor C. Wallace, PhD, CFS, FACN
and **Cara Harbstreet,** MS, RD, LD

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Our Purpose

The Produce for Better Health (PBH) Foundation, a 501(c)3, is the only non-profit organization committed to helping people live happier, healthier lives by eating more fruits and vegetables in all their glorious forms every day.

Our Movement

Research shows, rather than a prescriptive recommendation to eat a certain amount of fruits and vegetables each day, consumers (particularly Gen Z and Millennials) want actionable, realistic and FUN approaches that make eating fruits and vegetables easy, helping them feel confident, happy and healthy.

That's where **PBH's Have A Plant™ movement** comes in. It's a way to tap into the emotional connection consumers have to the fruit and vegetable eating experience while inspiring long-term, sustainable behavior change. And it does so with a no-nonsense approach that's simple, understandable, and, importantly for this audience, non-prescriptive.

Learning Objectives

- Understand evidence-based research surrounding the role of fruits and vegetables in disease prevention and optimal health promotion.
- Vocalize federal fruit and vegetable recommendations and the importance of variety.
- Translate the research into practical applications, identifying smart solutions to help boost fruit and vegetable consumption among patients/clients.

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Performance Indicators

- 4.1.2 Interprets and integrates evidence-based research and literature in decision making.
- 6.2.4 Disseminates research or performance improvement outcomes to advance knowledge, change practice and enhance effectiveness of services.
- 8.3.6 Keeps abreast of current nutrition and dietetics knowledge and trends.

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Learning Need Codes

4000
Wellness and Public Health

4040
Disease Prevention

9020
Evaluation and Application of Research

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Overview

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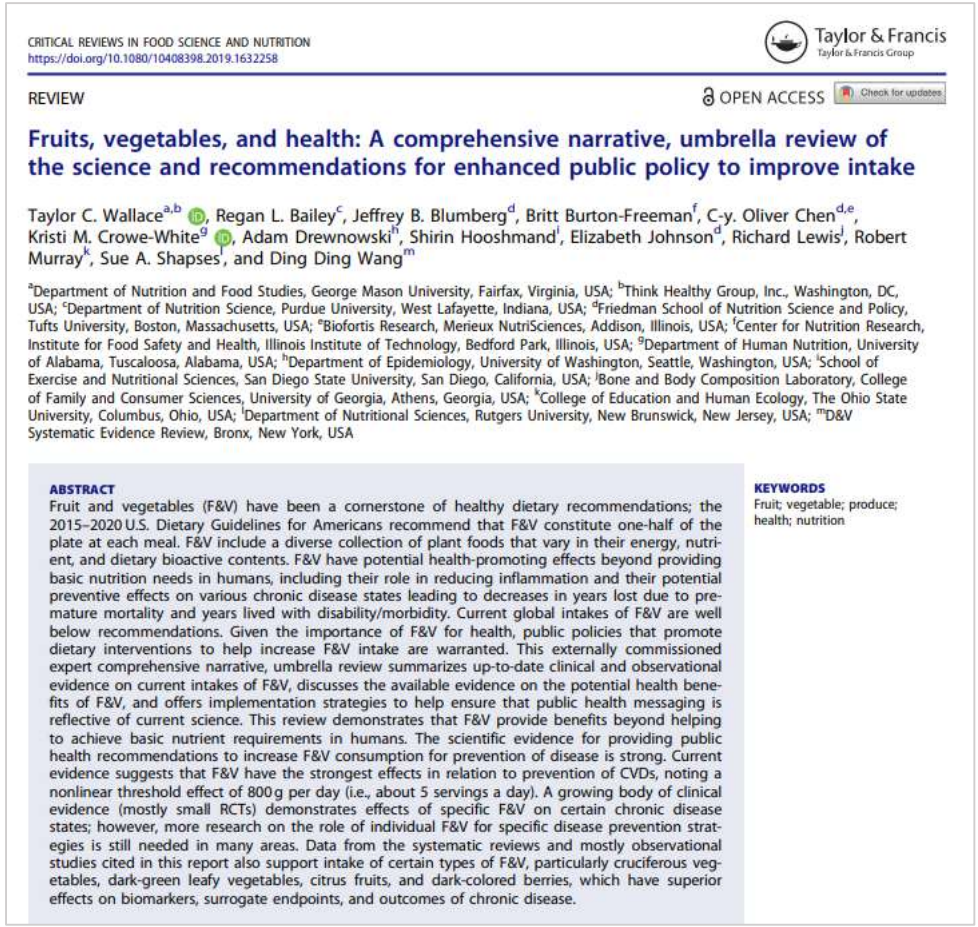
PBH commissioned an umbrella review of nearly 100 studies to summarize current clinical and observational evidence on the potential health effects of fruits and vegetables – fresh, frozen, canned, dried and 100% juice.

- Goal: Inform future research priorities and offer public health strategies that are reflective of the current science.
- Authored by Dr. Taylor Wallace, PhD along with 13 well-established nutrition scientists from academic centers such as Purdue University, Tufts University, University of Washington and The Ohio State University.
- Published in *Critical Reviews in Food Science and Nutrition* and is available for open access.
- Funding for this manuscript was provided through an unrestricted educational grant from the PBH Foundation. PBH had no role in the design, analysis, interpretation, or presentation of the data and results.



CRITICAL REVIEWS IN FOOD SCIENCE AND NUTRITION
https://doi.org/10.1080/10408398.2019.1632258

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REVIEW

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Fruits, vegetables, and health: A comprehensive narrative, umbrella review of the science and recommendations for enhanced public policy to improve intake

Taylor C. Wallace[a,b], Regan L. Bailey[c], Jeffrey B. Blumberg[d], Britt Burton-Freeman[f], C-y. Oliver Chen[d,e], Kristi M. Crowe-White[g], Adam Drewnowski[h], Shirin Hooshmand[i], Elizabeth Johnson[d], Richard Lewis[j], Robert Murray[k], Sue A. Shapses[l], and Ding Ding Wang[m]

[a]Department of Nutrition and Food Studies, George Mason University, Fairfax, Virginia, USA; [b]Think Healthy Group, Inc., Washington, DC, USA; [c]Department of Nutrition Science, Purdue University, West Lafayette, Indiana, USA; [d]Friedman School of Nutrition Science and Policy, Tufts University, Boston, Massachusetts, USA; [e]Biofortis Research, Merieux NutriSciences, Addison, Illinois, USA; [f]Center for Nutrition Research, Institute for Food Safety and Health, Illinois Institute of Technology, Bedford Park, Illinois, USA; [g]Department of Human Nutrition, University of Alabama, Tuscaloosa, Alabama, USA; [h]Department of Epidemiology, University of Washington, Seattle, Washington, USA; [i]School of Exercise and Nutritional Sciences, San Diego State University, San Diego, California, USA; [j]Bone and Body Composition Laboratory, College of Family and Consumer Sciences, University of Georgia, Athens, Georgia, USA; [k]College of Education and Human Ecology, The Ohio State University, Columbus, Ohio, USA; [l]Department of Nutritional Sciences, Rutgers University, New Brunswick, New Jersey, USA; [m]D&V Systematic Evidence Review, Bronx, New York, USA

ABSTRACT

Fruit and vegetables (F&V) have been a cornerstone of healthy dietary recommendations; the 2015–2020 U.S. Dietary Guidelines for Americans recommend that F&V constitute one-half of the plate at each meal. F&V include a diverse collection of plant foods that vary in their energy, nutrient, and dietary bioactive contents. F&V have potential health-promoting effects beyond providing basic nutrition needs in humans, including their role in reducing inflammation and their potential preventive effects on various chronic disease states leading to decreases in years lost due to premature mortality and years lived with disability/morbidity. Current global intakes of F&V are well below recommendations. Given the importance of F&V for health, public policies that promote dietary interventions to help increase F&V intake are warranted. This externally commissioned expert comprehensive narrative, umbrella review summarizes up-to-date clinical and observational evidence on current intakes of F&V, discusses the available evidence on the potential health benefits of F&V, and offers implementation strategies to help ensure that public health messaging is reflective of current science. This review demonstrates that F&V provide benefits beyond helping to achieve basic nutrient requirements in humans. The scientific evidence for providing public health recommendations to increase F&V consumption for prevention of disease is strong. Current evidence suggests that F&V have the strongest effects in relation to prevention of CVDs, noting a nonlinear threshold effect of 800 g per day (i.e., about 5 servings a day). A growing body of clinical evidence (mostly small RCTs) demonstrates effects of specific F&V on certain chronic disease states; however, more research on the role of individual F&V for specific disease prevention strategies is still needed in many areas. Data from the systematic reviews and mostly observational studies cited in this report also support intake of certain types of F&V, particularly cruciferous vegetables, dark-green leafy vegetables, citrus fruits, and dark-colored berries, which have superior effects on biomarkers, surrogate endpoints, and outcomes of chronic disease.

KEYWORDS

Fruit; vegetable; produce; health; nutrition

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The Review: Methodology, Data and Key Findings

The Health Benefits of Fruits and Vegetables

Taylor C. Wallace, PhD, CFS, FACN
Think Healthy Group, Inc. and George Mason University

Disclosures

- Think Healthy Group, Inc.
- George Mason University
- J. Diet Suppl. / J Am Coll Nutr.
- Sizzling Science™
- Zoco Media, Atkins Nutritionals, and Biocell Collagen
- Visit www.drtaylorwallace.com for my slides and all conflicts of interest.

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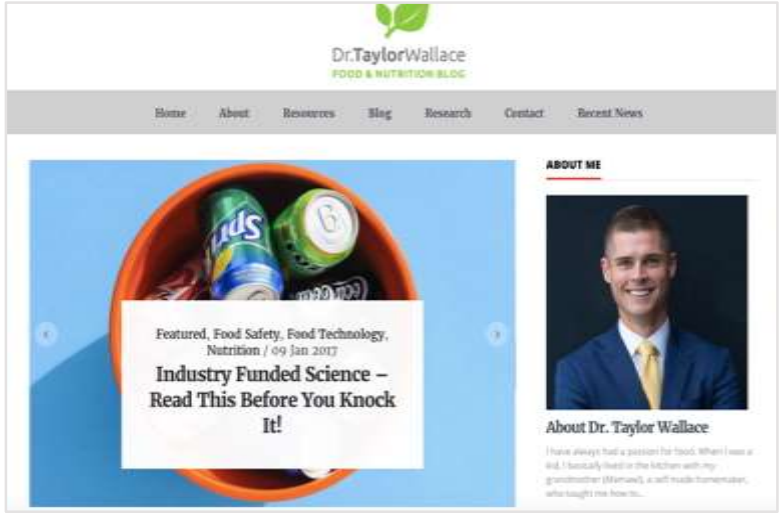
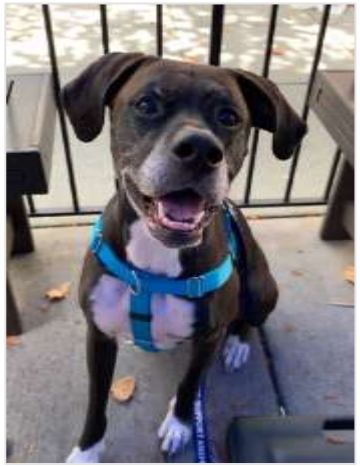
A Little About Me…

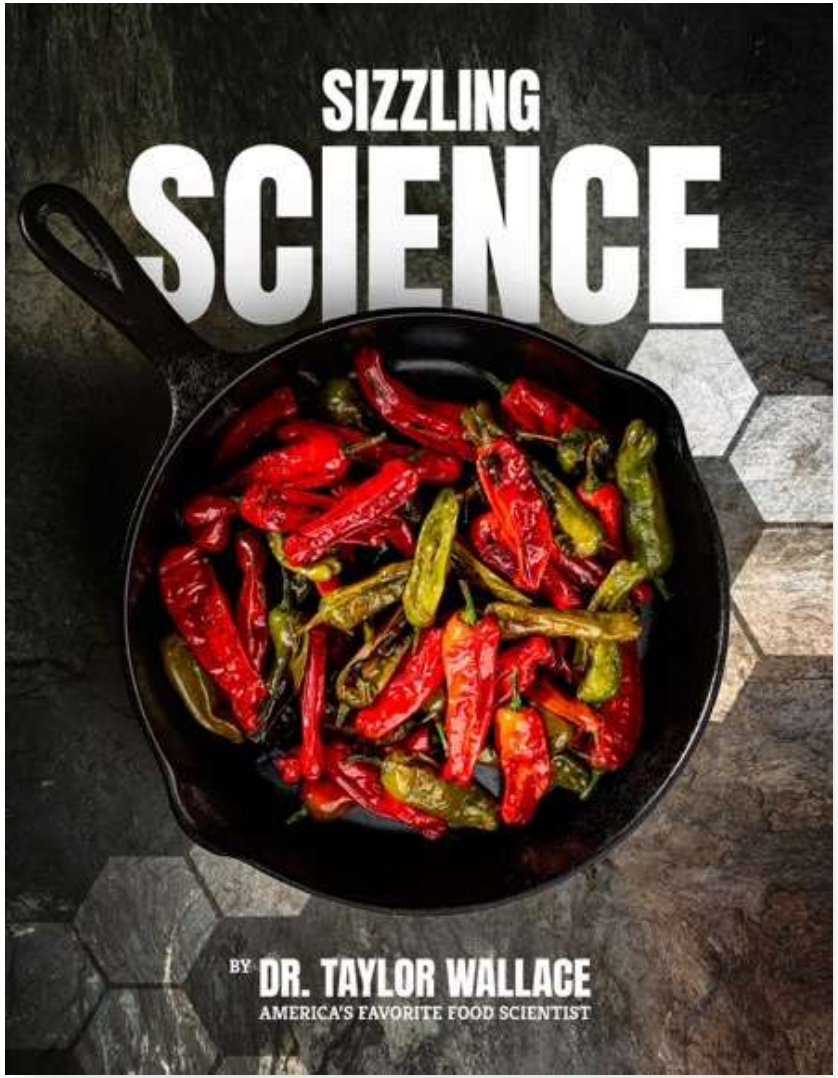


Risky Behavior



Sizzling Science™

www.sizzlingscience.org



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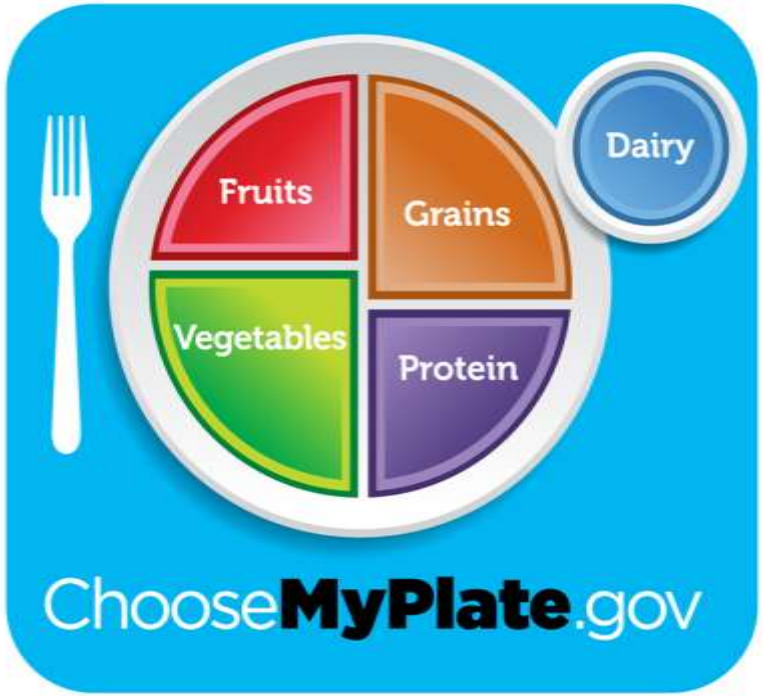
Unrestricted Educational Research Grant Provided By:

Fruits, Vegetables and Dietary Guidance

Dietary risk factors associated with poor health in the United States are those considered to be low in fruits, vegetables, whole grains, nuts and seeds, and high in refined carbohydrates, added sugars, sodium, and certain saturated fats.

Diets high in fruits and vegetables have historically held a place in dietary guidance because of their generally low-energy and high-nutrient density.



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Fruits, Vegetables and Dietary Guidance

Most nutritional and global recommendations include consumption of at least 2-servings of fruits and 3-servings of vegetables per day for adults.

More than 100 countries worldwide have developed food based dietary guidelines adapted to their nutrition situation, food availability, culinary cultures, and eating habits that encourage fruits and vegetable consumption.

88% of countries face a serious burden from two or three forms of malnutrition: acute and/or chronic undernutrition, micronutrient deficiencies, obesity, and diet related diseases (e.g., type-2 diabetes).

https://www.who.int/whr/2002/en/
https://www.canada.ca/en/health-canada/serv- ices/canada-food-guides.html
https://health.gov/dietaryguidelines/2015/

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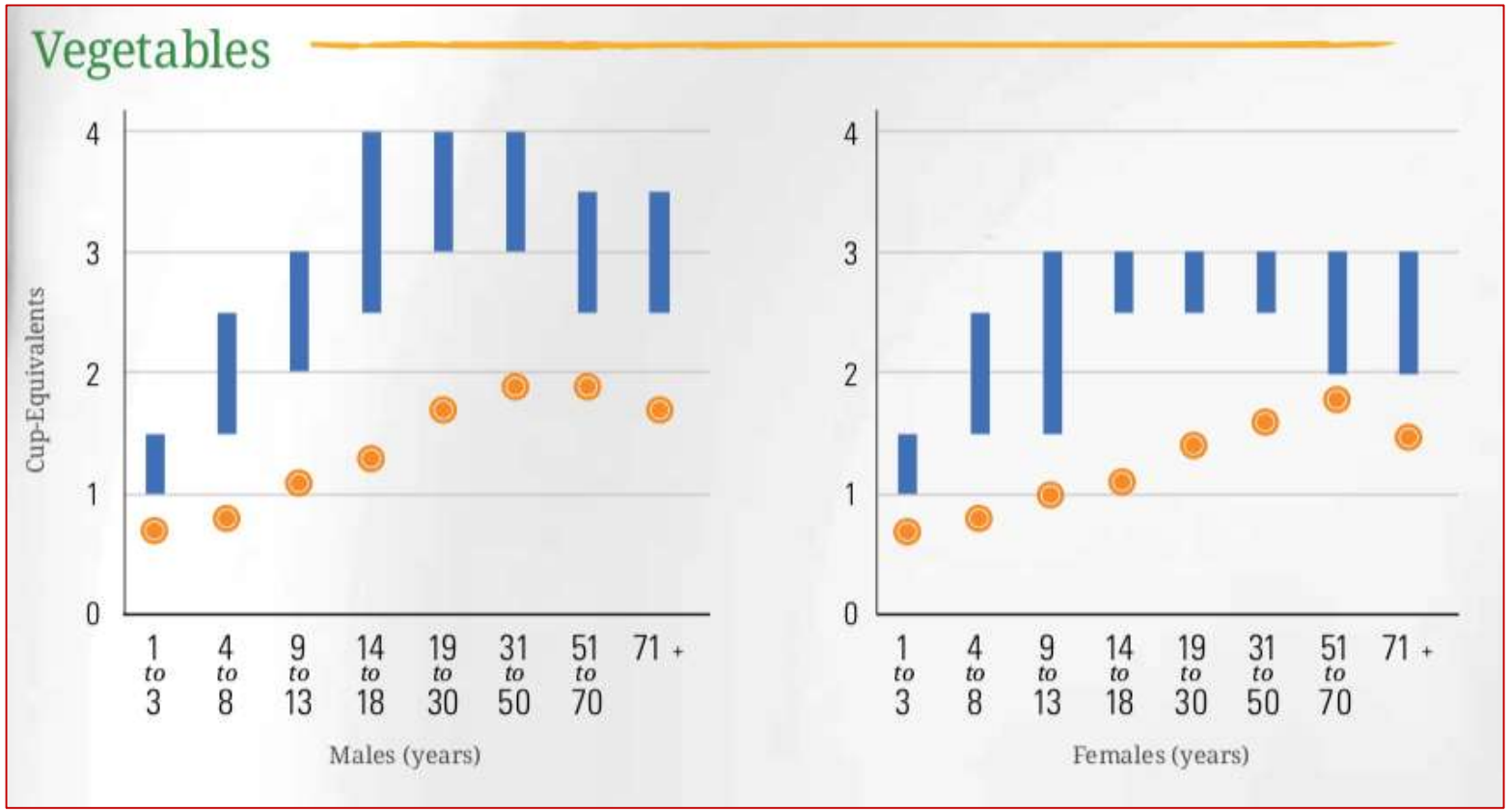
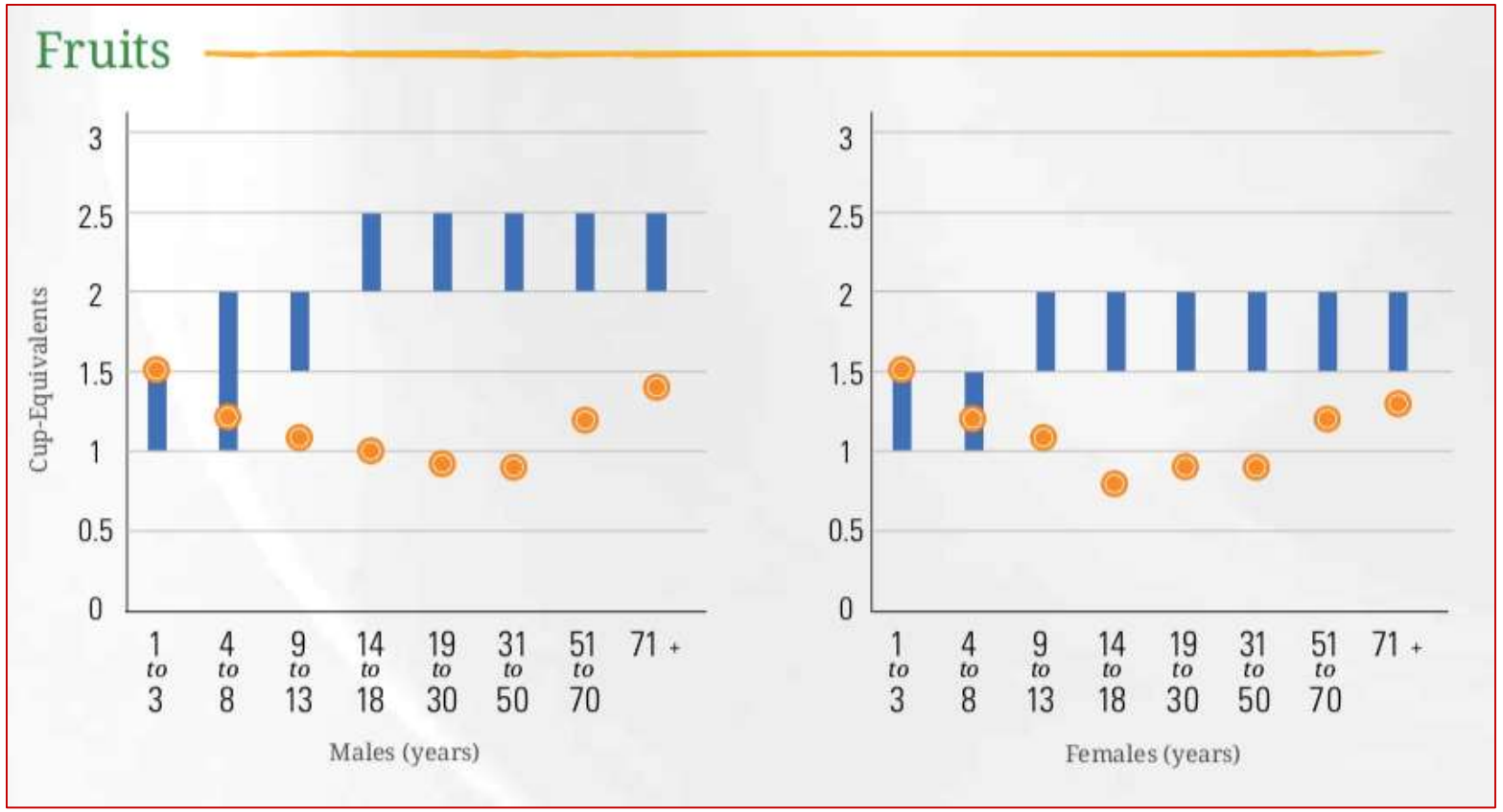
Current Gaps in Vegetable Intake



https://health.gov/dietaryguidelines/2015/

Current Gaps in Fruit Intake



https://health.gov/dietaryguidelines/2015/

Current Gaps in Fruit and Vegetable Intake

Fruit and vegetable consumption losses are tied to two common behaviors:

1. Decline in dinner side dishes for vegetables.
2. Reduced consumption of fruit juice at breakfast.

Staples such as orange juice, lettuce/salad, corn and green beans have led the declines.

Fewer side salad dishes also reduce salad-related produce, such as tomatoes and cucumbers.

Produce for Better Health Foundation's *State of the Plate,* 2015

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Dietary Bioactive Compounds

Fruits and vegetables are a primary source of dietary bioactive compounds, defined by the National Institutes of Health as "*compounds that are constituents in foods and dietary supplements, other than those needed to meet basic human nutritional needs, which are responsible for changes in health status*."

https://ods.od.nih.gov/Research/Bioactive_Food_Components_Initiatives.aspx




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Dietary Bioactive Compounds

The Chinese Nutrition Society has published DRI-like values for non-nutrient substances.

Specific Proposed Level (SPL) is similar to the Adequate Intake (AI) in the U.S. and Canada.

http://dg.en.cnsoc.org/index.html

Table 3. Specific proposed levels and upper limits for non-nutrient substances published by the Chinese Nutrition Society.

Non-nutrient substance	Specific proposed level	Upper limit
Dietary fiber (g/d)[a]	25–30	IE
Soy isoflavones (mg/d)	50	80
Lutein (mg/d)	6	60
Lycopene (mg/d)	18	50
Phytosterols (g/d)	0.8	2.4–3.9
Glucosamine (g/d)	1.0–1.5	IE
Anthocyanins (mg/d)	50	NN
Proanthocyanidins (mg/d)	200	800
Curcumin (mg/d)	IE	180
Resveratrol (g/d)	IE	2.5
L-carnitine (mg/d)	IE	2000
Fructooligosaccharides (g/d)	IE	15
R-GABA	IE	NN
Allicin	IE	IE
Chlorogenic acid	IE	IE
Lipoic acid	IE	IE
Catechins	IE	NN
Isothiocyanates	IE	IE
Quercetin	IE	IE

Adapted from the Chinese Nutrition Society (2018). GABA, γ-aminobutyric acid; IE, inadequate evidence; NN, not necessary.
[a]Adequate intake.

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Emerging Biomarkers of Dietary Intake

A biomarker is a measurable substance that is taken to reflect some underlying physiological state, whether normal or pathological. In theory, almost any measurement that reflects change in biochemical processes, structures or functions can be used as a biomarker.

Biomarkers can be used to:

- Assess dietary intakes (exposure).
- Assess biological responses, or responses to a behavior or nutrition intervention.
- Predictor of a clinical endpoint or disease outcome.
- Measure predisposition to a disease or response to a treatment.

Nutrition in the Prevention and Treatment of Disease, 2017.

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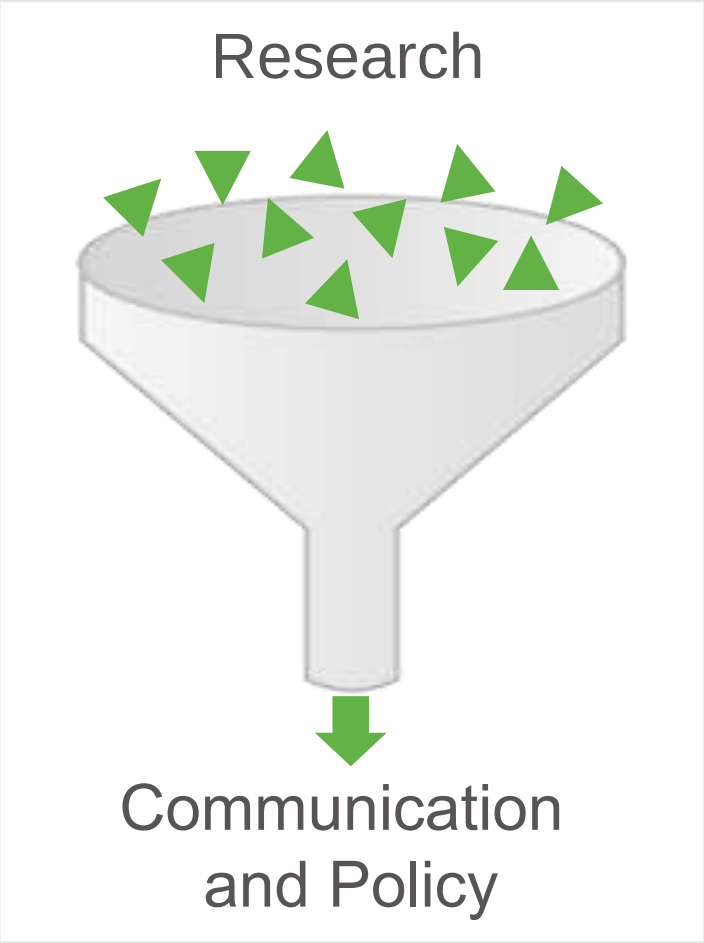
Research Objective

To summarize up-to-date clinical and observational evidence on the health benefits of fruits and vegetables, and offer implementation strategies to help ensure the public health messaging is reflective of current science.



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Methods

Standard procedures for performing an umbrella review.

Included all systematic reviews (in English language) of human studies with a health-related outcome.

Table 4. Literature search strategy.

PubMed Search
(("fruit"[MeSH Terms] OR "fruit"[All Fields]) OR ("fruit"[MeSH Terms] OR "fruit"[All Fields] OR "fruits"[All Fields])) AND (("vegetables"[MeSH Terms] OR "vegetables"[All Fields] OR "vegetable"[All Fields]) OR ("vegetables"[MeSH Terms] OR "vegetables"[All Fields])) AND systematic[sb]
Limited to studies in the English language.

Int J Evidence-Based Healthcare. 2015;13(3):132.

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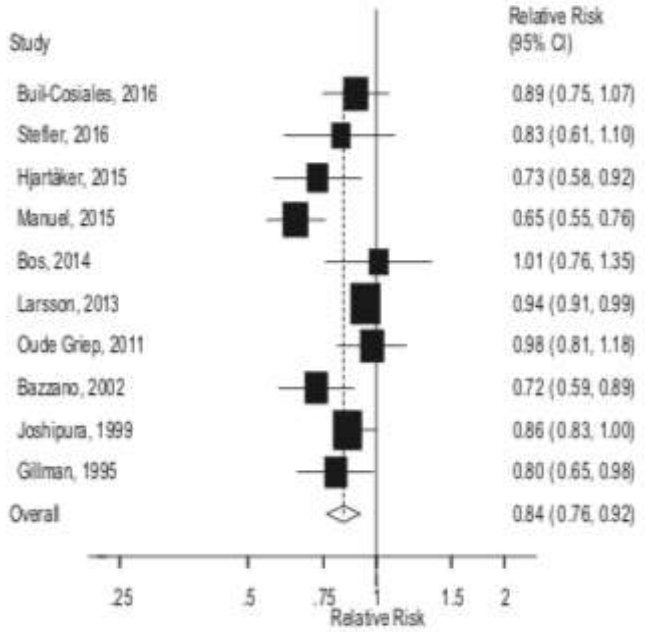
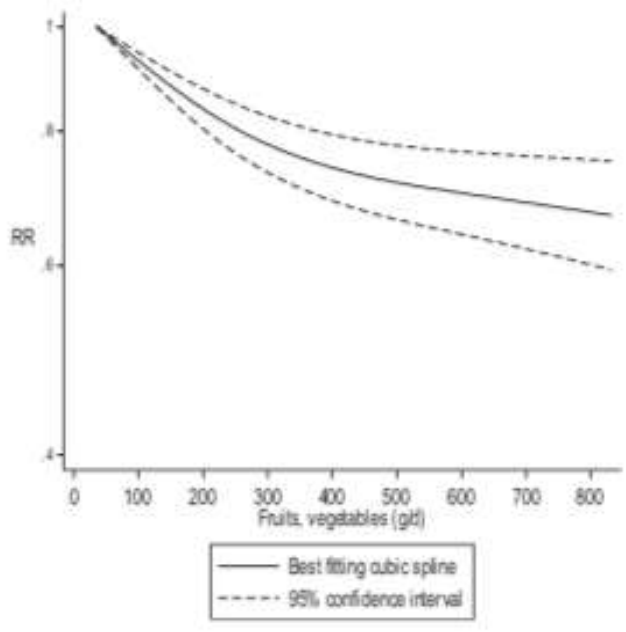
Results

Data extracted from 96 systematic reviews. Most assessed high vs. low intake of fruits and vegetables. Fewer assessed if dose-response relationships exist (*need for more of these types of systematic reviews in nutrition*).

Crit Rev Food Sci Nutr. 2019 (online first).



High vs. Low meta-analysis



Dose-response meta-analysis

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Results: All-Cause Mortality

The most recent systematic review and meta-analysis found that with increasing intake, the risk of all-cause mortality decreased for:

Fruits by 6% per daily serving.
(RR 0.94; $CI_{95\%}$ 0.92 - 0.97)

Vegetables by 4% per daily serving.
(RR 0.96; $CI_{95\%}$ 0.95 - 0.98)

Crit Rev Food Sci Nutr. 2019 (online first).
J Clin Nutr. 2017;105(6):1462.

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Results: Cancer (n=44 SRs)

Cancer is the second leading cause of death in the US and worldwide. It is responsible for 1.6 and 8.8 million deaths domestically and globally, respectively.

The most recent systematic review and dose-response meta-analysis found that with increasing intake, the risk of total cancer incidence decreased for:

Fruits and vegetables by 3% per daily serving. (RR 0.97; $CI_{95\%}$ 0.95 – 0.99)

Fruits by 4% per daily serving. (RR 0.96; $CI_{95\%}$ 0.94 - 0.99)

Vegetables by 4% per daily serving. (RR 0.96; $CI_{95\%}$ 0.93 - 0.99)

Crit Rev Food Sci Nutr. 2019 (online first).
Int J Epidemiol. 2017;46(3):1029.

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Results: Cardiovascular Disease (n=16 SRs)

CVD is the leading cause of death in the US and worldwide. It is responsible for 17.9 million deaths (31% of deaths) globally.

The most comprehensive systematic review and meta-analysis found a nonlinear dose-response relationship between intakes of up to 800 g per day (about 5-serving) and CHD, stroke and CVD.

14/16 systematic reviews reported statistically significant effects on intermediate markers (e.g., hypertension) and outcomes.

Crit Rev Food Sci Nutr. 2019 (online first).
Int J Epidemiol. 2017;46(3):1029.

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Results: Type-2 Diabetes (n=6 SRs)

Type-2 diabetes is estimated to affect 592 million people by 2035. It is widely accepted that dietary bioactive compounds in fruits and vegetables play a role in modulating insulin sensitivity.

The most recent systematic review and meta-analysis found a dose-response relationship between fruit and vegetable intake and risk of type-2 diabetes:

- Fruits and vegetables by 2% per daily serving (RR 0.98; 95%CI 0.96 – 1.00)
- Data is somewhat inconsistent.

Crit Rev Food Sci Nutr. 2019 (online first).
Eur J Epidemiol. 2017;32(5):363.

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Results: Bone Health (n=1 SR)

The National Osteoporosis Foundation (NOF) estimates the prevalence of osteoporosis and low-bone mass to be 10.3% and 43.9%, respectively, of U.S. adults age ≥50.

The most recent systematic review and high vs. low meta-analysis found that with increasing intakes of fruits and vegetables, the risk of osteoporosis decreased by 32% and 13%, respectively.

In youth cross-sectional studies indicate that fruit and vegetable intake is associated with better bone development.

Crit Rev Food Sci Nutr. 2019 (online first).

J Bone Min Res. 2014;29(11):2520.

Food Func. 2018;9(5):2607.

Osteoporos Int. 2016;27(4):1281.

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Results: Other Health Conditions

In addition to the five conditions addressed in this webinar, it is important to note that the review also examined fruits and vegetables impact on the following health outcomes:

- Nearly 17 different types of cancer
- Immunity
- Infection
- Lung health
- Mental health and cognition
- Eye health
- Skin health
- Gut health
- Pulmonary health
- Other health outcomes

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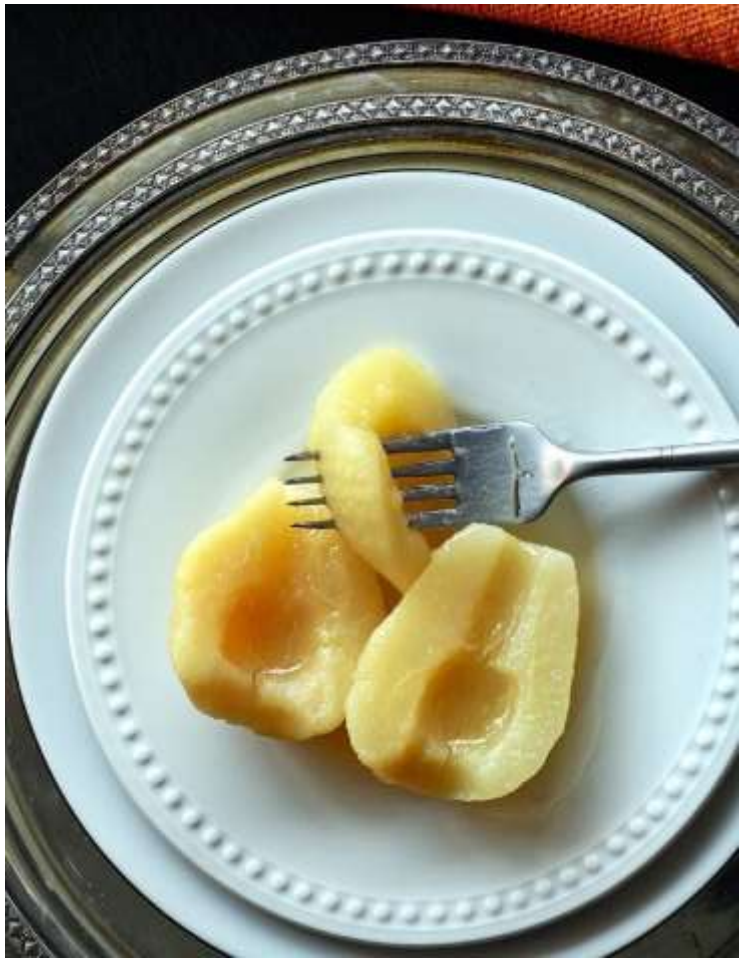
Results: Increasing Consumption

Storage and processing technologies, such as freezing, canning, drying, and juicing all serve to transform perishable produce into products that can be consumed year-round.

- 100% fruit juice – no evidence of clinically relevant weight gain in children or adults.
- Increases diet quality.
- Soda vs. 100% fruit juice.
- Is fiber really an issue here?



Crit Rev Food Sci Nutr. 2019 (online first).

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Future Research Needs and Key Questions

- Large RCTs with adequate study designs.
- Higher quality systematic reviews utilizing dose-response meta-analysis.
- Development of novel biomarkers.
- Defining intake with precise measures (e.g., grams) versus servings.
- Continued improvement of food composition databases.

Crit Rev Food Sci Nutr. 2019 (online first).

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Conclusion

Scientific evidence for providing public health recommendations to increase fruit and vegetable consumption for prevention of disease is strong.

Fruits and vegetables have the strongest effects in relation to prevention of CVD, noting a threshold effect at about 800 g (i.e., 5-servings) per day.

Certain types of fruits and vegetables, particularly cruciferous vegetables, dark-green leafy vegetables, citrus fruits and dark colored berries have superior effects in relation to chronic disease prevention.

Crit Rev Food Sci Nutr. 2019 (online first).

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Manuscript Available Online

Published online-first in the journal *Critical Reviews in Food Science and Nutrition*.

Attached to the webinar notes.

CRITICAL REVIEWS IN FOOD SCIENCE AND NUTRITION
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REVIEW

Fruits, vegetables, and health: A comprehensive narrative, umbrella review of the science and recommendations for enhanced public policy to improve intake

Taylor C. Wallace[a,b], Regan L. Bailey[c], Jeffrey B. Blumberg[d], Britt Burton-Freeman[f], C-y. Oliver Chen[d,e], Kristi M. Crowe-White[g], Adam Drewnowski[h], Shirin Hooshmand[i], Elizabeth Johnson[d], Richard Lewis[j], Robert Murray[k], Sue A. Shapses[l], and Ding Ding Wang[m]

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ABSTRACT

Fruit and vegetables (F&V) have been a cornerstone of healthy dietary recommendations; the 2015–2020 U.S. Dietary Guidelines for Americans recommend that F&V constitute one-half of the plate at each meal. F&V include a diverse collection of plant foods that vary in their energy, nutrient, and dietary bioactive contents. F&V have potential health-promoting effects beyond providing basic nutrition needs in humans, including their role in reducing inflammation and their potential preventive effects on various chronic disease states leading to decreases in years lost due to premature mortality and years lived with disability/morbidity. Current global intakes of F&V are well below recommendations. Given the importance of F&V for health, public policies that promote dietary interventions to help increase F&V intake are warranted. This externally commissioned

KEYWORDS

Fruit; vegetable; produce; health; nutrition

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The Research Team

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Click on name to view researcher profile.

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Crit Rev Food Sci Nutr. 2019 (online first).

Key Messages and Practical Application

Fruits and vegetables – fresh, frozen, canned, dried and 100% juice – are vital for healthy bodies and minds, throughout all stages of life.

- Fruits and vegetables have benefits beyond helping people achieve basic nutritional requirements, including improved life expectancy and overall quality.
- Fruits and vegetables are nutrient-rich, delicious plant foods. For relatively very few calories, fruits and vegetables are primary sources of nutrients people need for healthy lives, such as potassium, vitamin C, and vitamin A.
- Fruits and vegetables are superheroes – millions of deaths worldwide may be attributed to not eating enough fruits and vegetables.
- Although research shows that fruits and vegetables are important for fueling healthy bodies and minds throughout all stages of life, nine in 10 Americans do not meet fruit and vegetable intake recommendations.[1,2]

1. DCAC. 2015. Scientific report of the 2015 Dietary Guidelines Advisory Committee: Advisory report to the Secretary of Health and Human Services and the secretary of agriculture. Washington, DC: U.S. Department of Agriculture Agricultural Research Service.
2. USDA. 2018a. 2015-2020 Dietary Guidelines for Americans. Accessed May 4, 2018. http://health.gov/dietaryguidelines/2015

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As evident by this review, it is clear that the single most important thing we can do to improve public health is to help people eat at least five servings of fruits and vegetables each day, for happier, healthier lives.

- Offer patients, clients and consumers creative, yet realistic advice to help them enjoy more fruits and vegetables – fresh, frozen, canned, dried and 100% juice – each day.
- Bottom line: When it comes to fruits and vegetables, more is more!
- Dietary guidance should continue to call for people to enjoy at least five servings of fruits and vegetables each day, in all forms, to improve health and reduce chronic disease risk.

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Boosting Fruit & Vegetable Intake with Variety

Variety is key throughout the week – eat the rainbow!

Good sources of fruits and veggies with health-promoting bioactive compounds:

- Cruciferous vegetables
- Dark-green leafy vegetables
- Citrus fruits
- Dark-colored berries

Get creative in the kitchen!

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Ripe and Ready Solutions for Fruit and Vegetable Intake

Fruits

- Blend into smoothies and smoothie bowls
- Add dried fruit (e.g., cranberries, apricots) to trail mix
- Top oatmeal, cereal and pancakes/waffles with berries
- Create fruit salad with a variety of colorful fruits

Vegetables

- Add to casseroles, pasta, rice dishes and breakfast scrambles/bakes
- Boost tacos and stir-fry dishes with a variety of veggies
- Slice and pair with hummus
- Incorporate into smoothies and smoothie bowls (e.g., avocado, spinach)

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While research is still emerging, eating fruits and vegetables, as part of a healthy dietary pattern, has been associated with overall life satisfaction and happiness, as well as some improved cognitive abilities and mental health.

There is joy in the sweet-tasting, healthy eating experience of fruit, and smart satisfaction associated with the success of preparing vegetables as a meal, or part of a meal.

It is critical to impart the emotional benefits of eating fruits and vegetables to our clients, to help encourage adherence to healthy dietary patterns.

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Join The Movement

I was there for THE LAUNCH…

have a plant™

fruitsandveggies.org

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September is **National Fruits & Veggies Month™**, a four-week long celebration of life's favorite plants – fruits and veggies!

Join the Have A Plant™ Movement and take a moment to enjoy all the forms of fruits and veggies that you know and love – fresh, frozen, canned, dried and 100% juice – that taste great and are proven to support your health and happiness!

Follow PBH's social channels for weekly contests, creative tips/tricks from PBH's Fruit & Vegetable Ambassadors in Action (FVAA), and more!

Facebook: @fruitsandveggies
Instagram: @fruitsandveggies
Twitter: @Fruits_Veggies
LinkedIn: Produce For Better Health Foundation

Fruits and Veggies really are… Food Rooted in a Better Mood

The Have A Plant™ Pledge

Take the pledge to add one more fruit and/or vegetable to your routine, every day in September. Learn more at fruitsandveggies.org.

Spread the love! Download the Have A Plant™ Pledge graphic to share on your social media channels as your profile picture and/or on social channels using **#haveaplantpledge**.

Follow PBH's social channels and WIN! Weekly social media contests provide multiple chances to win cash prizes and lots of opportunities for you to show us and the world how much you love fruits and veggies!

PRODUCE FOR™ BETTER HEALTH FOUNDATION

The Benefits of Eating More Fruits and Vegetables Go Beyond Health and Nutrition

Fruits and vegetables not only help to ward off chronic disease, but can also help us feel confident and proud that we are making the best decisions to curb hunger, fuel our bodies, and get the nutrients we need to support our day-to-day activities, long-term health and happiness.

Fruits and vegetables can help us to have a more positive outlook on life.

Here's the plan…Have a plant today!

have a plant™
fruitsandveggies.org

PRODUCE FOR™ BETTER HEALTH FOUNDATION


Q&A

Join The Movement

- The research is impressive – eating more fruits and vegetables has health *and* emotional benefits.
- Have A Plant™ aims to inspire Americans with actionable, realistic and FUN steps to connect eating fruits and vegetables with feeling happier and healthier.
- September is National Fruits & Veggies Month™ (NFVM) and this year's NFVM theme is *Have A Plant™, Food Rooted in a Better Mood.*
- Presentation slides and continuing education certificates will be sent out via email following this webinar.
- Review paper: https://www.tandfonline.com/doi/full/10.1080/10408398.2019.1632258

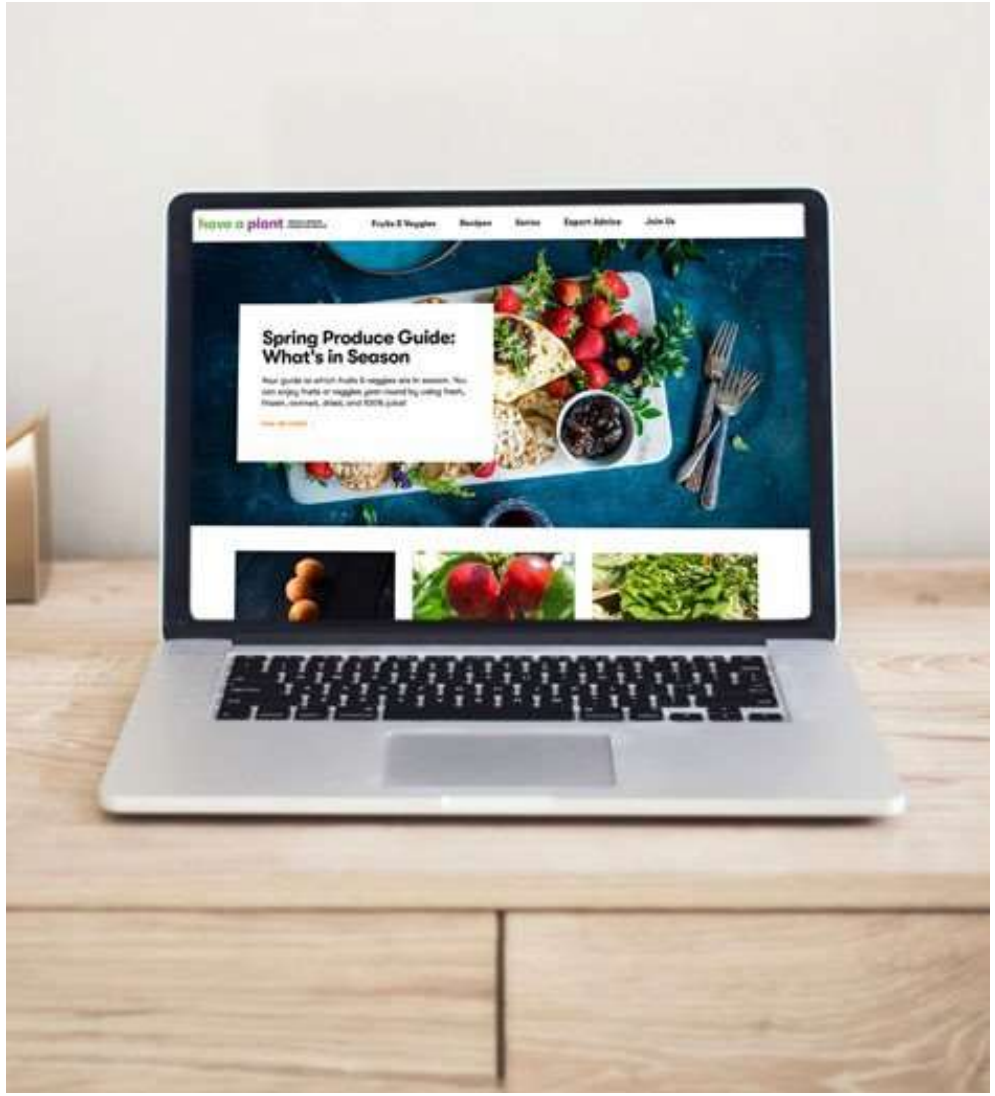
PRODUCE FOR™ BETTER HEALTH FOUNDATION

fruitsandveggies.org

For more information and resources, visit PBH's new highly interactive and visually enticing digital ecosystem.

Our new site reimagines and refreshes our most popular content to immerse Gen Z and Millennial consumers in an inspirational fruit and vegetable culture. Resources include, but are not limited to:

- Stories
- Recipes
- Expert Advice
- Research
- Series regarding special interests like Diabetes, or Seasonal Fruits and Veggies



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