

## **RESEARCH ON 100% JUICE**

### [Pure 100% fruit juices – more than just a source of free sugars? A review of the evidence of their effect on risk of cardiovascular disease, type 2 diabetes and obesity](#)

Ruxton, Carrie HS, Emma Derbyshire, and John L. Sievenpiper.

**Nutrition Bulletin** 46.4 (Nov 2021): 415-431

In this study researchers conducted 20 systematic reviews and meta-analyses published since 2014. The authors evaluated the relationships between 100% fruit juice consumption and nutritional adequacy, as well as biomarkers for cardiovascular disease.

**Key Findings:** Moderate consumption of 100% fruit juice (up to 200 ml/daily) may benefit vascular function and significantly reduce the risk of cardiovascular disease, without a significant increase in the risk of obesity, type 2 diabetes, dyslipidemia, or poor glycemic control.

- On average, adults with increased consumption of 100% fruit juice were associated with higher intakes of energy, total/free sugars, vitamin C, vitamin B, potassium, magnesium, calcium and vitamin D; in children, juice consumption were associated with higher vitamin C intake and Healthy Eating Index scores.
- To protect dental health, it is recommended to consume 100% fruit juice at mealtimes.

### [Fruit Juices: Are They Helpful or Harmful?](#)

Carrie HS Ruxton and Madeline Meyers

**Nutrients**, May, 2021

The authors performed a series of systematic reviews and meta-analyses of fruit juice and health outcomes over the three years prior to the publication of the study. They focused their review on finding literature that showed public health benefits and risks of consuming fruit juice.

**Key Findings:** The data in the study found fruit juice consumption, in appropriate amounts, does not increase the risk of obesity, type 2 diabetes, cardiovascular disease or poor glycemic control. In fact, regular daily consumption appears to confer *health benefits* in terms of vascular function and reduced blood pressure. Furthermore, the

researchers found that studies have reported fruit juice consumption is associated with lower risk of cardiovascular disease and stroke. The authors also found that:

- Fruit juices are not the same as other SSB's in terms of health effects and nutritional composition. SSB's are associated with negative health side effects, such as weight gain, type 2 diabetes, and obesity. Fruit juice does not have this association.
- By swapping 75-100% of SSB's with fruit juice, a person may decrease the risk of developing type 2 diabetes by a .74 hazard ratio and CHD by a .85 hazard ratio.
- A greater association exists between fruit juice consumption and reduction in stroke mortality risk than in whole fruits or vegetables and stroke mortality.
- Nutrients in juice, such as potassium, vitamin C, folate, etc. can have an anti-inflammatory and antioxidant effect when juice is regularly consumed.
- A 2020 study found no statistical association between regular fruit juice consumption and body mass index or weight gain in adults.

#### [A longitudinal study of fruit juice consumption during preschool years and subsequent diet quality and BMI](#)

Li Wan, Phani Deepti Jakkilinki, Martha R. Singer, M. Loring Bradlee & Lynn L. Moore  
**BMC Nutrition**, May 2020

Longitudinal study, researchers tracked diet records as well as height and weight data from 100 children 3-6 years of age enrolled in the Framingham Children's Study and followed them for 10 years.

**Key Findings:** Drinking 100% fruit juice early in life is associated with healthier dietary patterns in later childhood without adversely impacting weight gain.

- Preschoolers with higher intakes of 100% fruit juice ( $\geq 1$  cups/day) had significantly higher intakes of whole fruit and total fruit at 14-17 years of age than those children who consumed little juice ( $< 0.5$  cups/day).
- Preschoolers who consumed more fruit juice in the early years of childhood consumed more whole fruit at the same time and continued to consume more whole fruit into adolescence.
- Preschoolers who drank more 100% fruit juice ( $\geq 0.75$  cups/day) were 3.8 times more likely to meet current Dietary Guideline recommendations for whole and total fruit intake during adolescence than those preschoolers with low intakes.
- Those children with higher fruit juice intakes during preschool years had significantly higher diet quality scores (6 points higher according to 2015 Healthy Eating Index Scores) than those children with lower juice intakes at all ages.
- Fruit juice consumption was not associated with change in Body Mass Index (BMI) during childhood and into middle adolescence.

#### [Pure Fruit Juice and Fruit Consumption Are Not Associated with Incidence of Type 2 Diabetes after Adjustment for Overall Dietary Quality in the European Prospective Investigation into Cancer and Nutrition–Netherlands \(EPIC-NL\) Study](#)

Floor R Scheffers, Alet H Wijga, W M Monique Verschuren, Yvonne T van der Schouw, Ivonne Sluijs, Henriëtte A Smit, Jolanda M A Boer  
**Journal of Nutrition**, January 2020

Large European prospective cohort study looking at adults age 20-69 years of age (at baseline) which assessed both fruit juice and fruit consumption related to incidence of Type 2 diabetes. Average mean follow up was 14.6 years.

**Key Findings:** In both low fruit consumers and high fruit consumers (consumption ranged from < 1 glass/week to > 8 glasses/week) **no association** was observed between pure fruit juice consumption and type 2 diabetes after adjustment for age, sex, educational level, physical activity, smoking, family history of diabetes, alcohol consumption, coffee consumption, DHD15-index, and fruit consumption. In addition, researchers noted that with pure fruit juice consumption of < 8 glasses/wk was significantly associated with a reduced risk of type 2 diabetes incidence. However, this association was attenuated and became nonsignificant after further adjustments. This study also found pure fruit juice drinkers had healthier dietary habits. *In conclusion, in our study, pure fruit juice and fruit consumption was not independently associated with the risk of type 2 diabetes incidence.*

[Perspective: The Role of Beverages as a Source of Nutrients and Phytonutrients](#)

Mario G Ferruzzi, Jirayu Tanprasertsuk, Penny Kris-Etherton, ConnieMWeaver, and Elizabeth J Johnson

**Advances in Nutrition**, November 2019

This review article uses scientific evidence to provide a better understanding of the role of beverages in the diet. A Medline search of observational studies, randomized controlled trials, and meta-analyses was undertaken using key beverage words. Nutrient density related to macronutrients, micronutrients and bioactives (phytonutrients) are discussed for several beverages including 100% juices. Also highlighted is how these beverages can be included as part of the Dietary Guidelines for America (DGA).

**Key Findings related to 100% juice:** Modeling food intake patterns showed that without 100% fruit juice diets would be substantially lower in vitamin C and potassium than for patterns including fruits plus 100% fruit juice. Data shows 100% juice is considered a key source of phytonutrients including carotenoids (e.g., orange, carrot, and tomato juice) and phenolic acids (e.g., purple grape, cranberry, and apple juice). Fortified juices are important for intake of key nutrients like vitamins C and D and calcium.

[Potential health benefits of \(poly\)phenols derived from fruit and 100% fruit juice](#)

Kacie K.H.Y. Ho, Mario G. Ferruzzi, and JoLynne D. Wightman

**Nutrition Reviews**, September 2019

This narrative review provides an overview of fruit (poly)phenols and their potential health benefits. It looks at polyphenols derived from fruit and 100% fruit juice. While the specific focus is on those polyphenols derived from dark-colored whole fruit and 100% fruit juice (eg, grapes, berries, pomegranate, and cranberry). Orange and apple is also discussed because these are commonly consumed fruits/100% fruit juices in the United States.

Results showed that similar to coffee and tea, fruit and fruit juices have been identified as major (poly)phenol contributors in the US diet. This research suggests bioactives found in fruit and fruit juice may have the potential to positively impact human health. Some of the health benefits associated with fruit polyphenols found in this study include reduced risk of cardiovascular disease, which is also supported by a study in the **American Journal of Clinical Nutrition** published in August 2019 by Gowri Ramen, and benefits to neurocognitive function and exercise performance.

**Key Findings:** Overall, 100% juice adds a significant number of bioactives to the American diet, *without negatively impacting weight status or chronic disease risk*. Fruit bioactives include carotenoids, polyphenols such as flavonoids and more.

[\*Intake of 100% Fruit Juice Is Associated with Improved Diet Quality of Adults: NHANES 2013–2016 Analysis\*](#)

Sanjiv Agarwal, Victor L. Fulgoni III, PhD and Diane Welland MS, RD  
**Nutrients**, October 2019

National Health and Nutrition Examination Survey (NHANES) 2013–2016 data (24-h dietary recall) from adults 19+ years (n = 10,112) was used to assess the diet quality and nutrient intakes and to isocalorically replace with 100% fruit juice intakes whole fruit equivalents in a modeling analysis. Approximately 16% of the population consumed 100% fruit juice on the day of recall and the mean per capita usual intake was 0.26 cups equivalent per day.

This nationally representative sample of US adults found 100% fruit juice consumption was associated with better nutrient intake and better diet quality than nonconsumption.

**Key Findings:** Consumers had higher diet quality (10% higher Healthy Eating Index, HEI 2015 score), and higher intakes of energy, calcium, magnesium, potassium, vitamin C and vitamin D than non-consumers. Consumption of 100% fruit juice was also associated with lower risk of being overweight/obese (–22%) and having metabolic syndrome (–27%). Replacement of 100% fruit juice intake with whole fruits equivalents had no significant effect on nutrients except for a small increase (+6.4%) in dietary fiber.

[\*Consumption Patterns of Milk and 100% Juice in Relation to Diet Quality and Body Weight Among United States Children: Analyses of NHANES 2011-16 Data\*](#)

Matthieu Maillot PhD, Florent Vieux, Colin D. Rehm PhD, Chelsea M. Rose PhD and Adam Drewnowski, PhD  
**Frontiers in Nutrition**, August 2019.

The American Academy of Pediatrics (AAP) has recommended placing limits on the consumption of milk and 100% juice by children. This NHANES analysis looked at beverage consumption patterns and body weight in children. There was no significant relation between 100% fruit juice, milk and water consumption and body weight status.

**Key Findings:** Diets in the top quartiles of diet quality (higher total HEI-2015 score) were associated with higher intakes of milk, 100% juice, and water compared to those in the lower quartiles (or who drank less). Secondly, there was no association between compliance with AAP recommendations and body weight status. In fact, lower compliance with AAP recommendations was associated with higher quality diets.

#### [100% Fruit Juice in Child and Adolescent Dietary Patterns](#)

Robert Murray MD (pediatrician)

**Journal of the American College of Nutrition**, July 2019 :1-6.

Review of scientific literature on weight status, health, dietary patterns and diet quality related to consumption of 100% fruit juice in children. Written by pediatrician Dr. Robert Murray, the article noted that a healthful dietary pattern can be composed of innumerable different combinations of foods and beverages, which affect the prevention and mitigation of chronic diseases.

**Key Findings:** The inclusion of 100% fruit juice improves the quality of an individual's dietary pattern not only by providing vitamins and minerals but also by adding the array of bioactive phytonutrients that are present in whole fruits. This report encourages parents and other consumers to *look at a child's total diet before judging foods or beverages "good" or "bad."* Foods should be judged not on individual attributes such as fat or sugar but on their contributions to the diet as a whole.

#### [Evaluating the Impact of the Revised Special Supplemental Nutrition Program for Women, Infants, and Children Fruit Juice Allotment on Fruit Intake, Dietary Quality, and Energy/Nutrient Intakes among Children 1-4 Years of Age](#)

Theresa Nicklas, PhD; Carol O'Neil PhD, RD; Victor Fulgoni, III, PhD

**International Journal of Life Sciences** October 2018 – December 2018 (quarterly publication) 7 (4): 146-156.

An analysis of 24-hour recalls from children 1-4 years who were Women, Infants and Children (WIC) participants or income-eligible nonparticipants in the NHANES 2007-2008 and 2011-2014 (before and after WIC package changes).

Despite a 50% decrease in fruit juice allotment from 288 to 128 fl oz. per day in the WIC Food package in 2009, this study found no significant changes in total fruit, whole fruit or fruit juice intake among children regardless of WIC status. There were no differences in the Healthy Eating Index-2015 total score. Subcomponent scores for "greens and beans" and for "fatty acid ratio" were higher in 2011-2014 than in 2007-2008 in children

participating in WIC. Scores for “sodium” were higher in 2011-2014 than in 2007-2008 in children not participating in WIC but income-eligible. The study also looked at the removal of fruit juice from the WIC package.

**Key Findings:** Data showed that the removal of fruit juice from the WIC package resulted in a 38-50% lower total fruit intake and had a significant negative impact on diet quality and nutrient intakes of children. This research supports continuing to include 100% fruit juice at the current levels in the WIC Food package and shows that there are nutritional benefits to consuming fruit juice for this population.

[\*Beverage consumption patterns among 4–19 y old children in 2009–14 NHANES show that the milk and 100% juice pattern is associated with better diets\*](#)

Matthieu Maillot, PhD, Colin D. Rehm, PhD, Florent Vieux, Chelsea M. Rose, PhD and Adam Drewnowski, PhD.

**Nutrition Journal** May 2018; 7(1):17:54

An analysis of NHANES data evaluating diet quality on children in four beverage categories: 1. Milk drinkers, 2. 100% juice drinkers, 3. Milk and 100% juice drinkers and 4. Other beverages. Milk drinkers had higher levels of dairy, calcium, potassium, vitamin A and vitamin D; 100% juice drinkers had higher levels of total fruit and vitamin C and the same amounts of whole fruit; milk and 100% juice drinkers had the highest Healthy Eating Index score (HEI) of all the groups, followed by 100% juice drinkers and then milk drinkers.

**Key Findings:** Based on this analysis, beverage patterns build around milk and 100% juice were associated with better dietary choices and higher quality diets. This supports current Dietary Guidelines which state that milk and 100% juice along with plain water, should be beverages of choice. The diets of milk and juice drinkers did not differ in terms of energy, total or added sugars, fiber or vitamin E.

[\*Review of 100% Fruit Juice and Chronic Health Conditions: Implications for Sugar-Sweetened Beverage Policy\*](#)

Brandon Auerbach, MD, MPH, Sepideh Dibey PhD, MPH, RDN, Petra Vallila-Buchman, MPH, Mario Kratz, PhD, James Krieger, MS

**Advances in Nutrition** April 2018; 9(2): 78- 85

This systematic review and meta-analysis evaluated the relationship between 100% fruit juice and various chronic health outcomes in children and adults. The study focused on cardiometabolic health outcomes, liver disease, and caries.

**Key Findings:** The study concluded that no adverse health effects were found to be associated with 100% juice consumption and diabetes, cardiovascular disease, glucose homeostasis, lipid levels, or blood pressure. *No significant associations were found between juice and weight gain in children or adults.* While, (based on limited data) the study did find an increased risk of tooth decay in children, overall the findings support

100% juice recommendations by the American Academy of Pediatrics and the Dietary Guidelines and the continued inclusion of juice in food public policy programs.

[100% Fruit juice and measures of glucose control and insulin sensitivity: a systematic review and meta-analysis of randomised controlled trials.](#)

Mary M. Murphy, PhD; Erin C. Barrett; Kara A. Bresnahan; Lelia M. Barraj  
**Journal of Nutritional Science** January 2018.

This systematic review and meta-analysis of 18 randomized controlled trials (RCT) evaluated the impact of 100% juice from fruits, such as apple, berry, citrus, grape, and pomegranate on fasting blood glucose, fasting blood insulin, or insulin resistance.

**Key Findings:** This study found 100% juice does not have a significant effect on fasting blood glucose, fasting blood insulin, or insulin resistance. Overall research suggests a neutral effect of 100% juice on glycemic control. The findings are consistent with previous research indicating that 100% fruit juice is not associated with an increased risk of developing Type 2 Diabetes and support a growing body of evidence that 100% fruit juice has no significant effect on glycemic control.

[Associations of 100% fruit juice versus whole fruit with hypertension and diabetes risk in postmenopausal women: Results from the Women's Health Initiative](#)

Brandon Auerbach, MD, MPH; Alyson J. Littman, PhD, MPH; Lesley Tinker, PhD, RD; Joseph Larson, MS; et. al.

**Preventive Medicine.** 2017 Dec. 105:212-218.

Longitudinal analysis of food frequency questionnaires of postmenopausal women enrolled in the Women's Health Initiative between 1993-1998. Standardized questionnaires assessed outcome every 6-12 months during an 7.8 year follow up. Study evaluated incidence of hypertension (n=36,314 incident cases/80,539 total participants) and diabetes (n=11,488 incident cases/114,219 total participants). In multivariable analyses there was no significant association comparing the highest to lowest quintiles of 100% fruit juice consumption (8oz/day compared to none) and incident hypertension or diabetes. There was also no significant association between whole fruit consumption and incident hypertension or diabetes.

**Key Finding:** Consuming moderate amounts of 100% fruit juice (8oz./day) or whole fruit was not significantly associated with risk of hypertension or diabetes among postmenopausal US women.

[Satisfying America's fruit gap: Summary of an expert roundtable on the role of 100% fruit juice](#)

Carol Byrd-Bredbenner, PhD, RDN; Mario Ferruzzi, PhD; Victor Fulgoni III, PhD; et. al.  
**Journal of Food Science.** June 2017; 82(7): 1523–1534.

Based on a roundtable discussion in 2016, of nutrition scientists and educators this commentary article examines the science regarding the effect of 100% fruit juice consumption on nutrient intakes and health outcomes. It focuses on three current fruit

intake versus recommendations in the United States and the role of 100% fruit juice in improving nutrient intakes, diet quality and health outcomes.

**Key Findings:** The 2015-2020 Dietary Guidelines for Americans (DGAs) notes that 100% fruit juice is not being over consumed, is not associated with obesity/overweight or childhood dental caries and does not compromise fiber intake. Participating experts agreed that there is no science-based reason to restrict access to 100% fruit juice in public health nutrition policy and programs such as WIC. They further believe that reducing or eliminating 100% fruit juice could lead to unintended consequences such as reduced daily fruit intake and increased consumption of less nutritious beverages.

[Fruit juice and change in BMI: A meta-analysis](#)

Brandon Auerbach, MD, MPH; Fred Wolf, PhD; Abigail Hikida, MD; et al.  
**Pediatrics.** March 2017; 139(4): e20162454.

Meta-analysis study conducted at the University of Washington and looking at 8 cohort studies related to juice intake and weight gain (BMI z scores) in children.

**Key Findings:** No association was found between 100% fruit juice consumption and weight gain in children older than six years old. In children ages 1 to 6 years old, fruit juice consumption was associated with a small (but clinically *insignificant*) amount of weight gain averaging a quarter pound over a one year period. Recommendations included more research is needed in this younger age group. These findings show 100% juice is not associated with obesity in children.

[Commentary: Fruit juice and child health](#)

Steven Abrams, MD; Stephen Daniels, MD, PhD  
**Pediatrics.** March 2017;139(4): e20170041.

This commentary written by current (Abrams) and former (Daniels) Chairs of the AAP's Committee on Nutrition, reviews the results of the Auerbach study (see above).

**Key Findings are:**

1. supports the new American Academy of Pediatrics guidance allowing 4 oz of juice for 1-3 years of age, 4 to 6 oz of 100% juice for children 4-6 years of age and 8 oz for children 7-18 years of age.
2. shows that 100% juice can be beneficial for helping children meet the dietary recommendations for fruit
3. supports the inclusion of 100% juice in the diets of young children and in public policy initiatives including government programs such as WIC.

[Dietary and economic effects of eliminating shortfall in fruit intake on nutrient intakes and diet cost](#)

Colin Rehm, PhD; Adam Drewnowski PhD  
**BMC Pediatrics,** July 2016; 16:83.

The study evaluated nutrient intake and diet cost on total fruit consumption shortfalls by conducting two modeling analyses on a nationally representative sample of 4-18 year old children from NHANES 2009-2010 data. The potential impact of filling the shortfall in total fruit consumption was projected with two models: one with whole fruit alone (WF model) or one with a combination of 100% fruit juice and whole fruit (FJ + WF model) in typical consumption patterns (2 parts fruit to 1 part juice). Juice consumption was capped using American Academy of Pediatrics (AAP) standards. The USDA national food prices database was used to estimate the cost of meeting the dietary recommendations for fruit. Selected nutrient and mineral intakes, as well as daily diet cost were estimated after eliminating the shortfall in fruit consumption, whole fruit alone and a combination of 100% juice and whole fruit.

Based on food cost data, the study concluded that meeting total fruit shortfalls by whole fruit alone increased diet cost by almost twice as much than with a combination of juice and fruit. Furthermore, while the whole fruit model did increase dietary fiber, the combination of juice and fruit showed a greater beneficial effect on vitamin C, potassium and calcium than just whole fruit alone.

**Key Findings:** Based on food cost data, the study concluded that meeting total fruit shortfalls by whole fruit alone increased diet cost by almost twice as much than with a combination of juice and fruit. Furthermore, while modeling only whole fruit consumption did increase dietary fiber, the combination of juice (one part) and fruit (two parts) showed a greater beneficial effect on vitamin C, potassium and calcium than just whole fruit alone.

The combination of fruit and juice is cost neutral while meeting fruit shortfalls with whole fruit alone increased cost. The fruit and juice model was nutritionally similar or better with the exception of fiber to the whole fruit model. The combination of 100% juice and fruit is an optimum way to meet fruit shortfalls.

[Replacing 100% fruit juice with whole fruit results in a trade off of nutrients in the diets of children](#)

Theresa Nicklas, PhD; Carol O'Neil PhD, RD; Victor Fulgoni, III, PhD  
**Current Nutrition and Food Science**, October 2015; 11(4): 267-273.

This study conducted two modeling strategies to evaluate nutrient intake and dietary impact of replacing 100% fruit juice with whole fruit in children ages 2-18 using the national NHANES 2007-2010 consumption data. Model 1 replaced 100% fruit juice with a composite of the top 20 most commonly consumed whole fruit. Model 2 replaced individual 100% fruit juice with the same fruit.

The data showed replacing 100% fruit juice with whole fruit resulted in no difference in energy intake and no difference in 85% of nutrients (17 out of 20). Of the three nutrients affected -- vitamin C, fiber and total sugars -- vitamin C significantly decreased in both models; dietary fiber slightly increased by one gram and only in Model 2; total sugars decreased significantly by a small amount (6 grams or 24 calories) only in Model 1.

**Key Findings:** Overall, fruit juice is nutritionally similar to whole fruit with a “trade-off” for vitamin C for fiber and total sugars and is an easy and important way to help children meet USDA Dietary recommendations. The study also mentions that 100% juice drinkers significantly consume more whole fruit and have better quality diets than non-juice drinkers.

[\*Impact of 100% fruit juice consumption on diet and weight status of children: An evidence-based review\*](#)

Kristi Crowe-White, PhD, RD; Carol O’Neil PhD, RD; J. Scott Parrott PhD; et al.  
**Critical Reviews in Food Science and Nutrition**, June 2015; 56(5): 871-884.

An independent in-depth critical systematic review conducted by the Academy of Nutrition and Dietetics, looking at research from 1995-2013 found drinking 100% juice was not associated with weight status or adiposity in children, 1-18 years of age. The study also found children consuming 100% juice had higher intake and adequacy of dietary fiber, vitamin C, magnesium and potassium. Weight status outcome measures included body mass index (BMI), BMI z-score, ponderal index, obesity, weight gain, adiposity measures, and body composition. Nutrient outcome measures included intake and adequacy of shortfall nutrients.

**Key Findings:** An independent, in-depth critical systematic review conducted by the Academy of Nutrition and Dietetics looking at research from 1995-2013 found drinking 100% juice is not associated with increased weight or adiposity in children. As part of a healthy diet, this evidence shows that consumption of 100% fruit juice can provide beneficial nutrients without contributing to pediatric obesity.

[\*Consumption of 100% fruit juice is associated with better nutrient intake and diet quality but not with weight status in children: NHANES 2007-2010\*](#)

Theresa Nicklas, PhD; Carol O’Neil, PhD, RD; and Victor Fulgoni, III, PhD  
**International Journal of Child Health and Nutrition**. May 2015; 4: 112-121.

This cross-sectional study conducted by researchers Theresa Nicklas at Baylor College of Medicine and Carol O’Neil at Louisiana State University, examined the impact of various levels of 100% fruit juice (FJ) consumption on intake of nutrients, diet quality, and weight in children 2-18 years of age, using NHANES 2007-2010. Researchers assessed Healthy Eating Index scores based on 24-hour dietary recall data. Average per capita consumption of 100% FJ consumed was 3.6 fl oz (50 kilocalories; 2.9% energy intake); 30% of children 2-6 years exceeded the recommendation for 100% FJ. Juice drinkers had higher intakes of vitamin C, magnesium, and potassium and overall higher diet quality (higher HEI scores); no difference was found in total fiber intake and no trends were seen in weight with increased amounts of 100% FJ consumed, even among those who consumed more than the recommended amount. In addition, 100% fruit juice consumers ate significantly more whole fruit than non-consumers and had lower intakes of total fat, saturated fat, sodium and added sugar. This research showed 100% juice did not replace milk in the diet.

**Key Findings:** Consumption of 100% fruit juice was associated with higher nutrient intake, better diet quality and greater consumption of whole fruit than non-fruit juice drinkers in a nationally representative sample of US children. In addition, drinking 100% juice was not associated with body weight and adiposity. Based on these results, 100% juice complements, rather than competes with, whole fruit consumption and does not replace milk in the diet.

Review of 2007-2010 NHANES data looking at a nationally representative sample of children age 2-18 years found children who drink 100% juice have higher intakes of vitamin C, magnesium, and potassium and overall higher diet quality. They also had lower intakes of total fat, saturated fat, sodium and added sugar and consumed significantly more whole fruit than non-consumers; no difference was found in total fiber intake.

[Commentary: 100% fruit juice perspectives amid the sugar debate](#)

Gail Rampersaud MS, RD

**Public Health Nutrition.** April 2015; 20: 1-8.

Review of research on 100% fruit juice related to body weight and adiposity, risk of type 2 diabetes, and nutritional impact on the diet in children and adults. This commentary paper conducted at the University of Florida concluded that there is no consistent evidence that 100% juice has an adverse impact on weight or other health conditions often associated with excess sugar or fructose intake. Current studies related to type 2 diabetes are ambiguous and more research is needed but fruit juice intake does not appear to be associated with key risk factors for diabetes or metabolic syndrome. One hundred percent fruit juice provides several key nutrients to the diet including vitamin C, folate potassium and magnesium and is associated with better overall diet quality.

**Key Findings:** One hundred percent fruit juice consumed in appropriate amounts is beneficial and not detrimental to health.

[Squeezing fact from fiction about 100% fruit juice: Workshop proceedings](#)

Roger Clemens PhD; Adam Drewnowski PhD; Mario Ferruzzi PhD; et al.

**Advances in Nutrition.** March 2015; 6(6-2): 236s-241s.

Overview of the science looking at current 100% fruit juice consumption levels, nutrient content, juice production, diet quality and health, fruit juice consumption and cognition, fruit juice related to cost and income level and fruit juice and weight status. This paper is based on presentations at 2014 Experimental Biology by Roger Clemens at the University of Southern California, Adam Drewnowski, Director, Center of Public Health and Nutrition at the University of Washington and Mario Ferruzzi of Perdue University. The preponderance of evidence supports the position that 100% fruit juice delivers essential nutrients and bioactives, which can improve quality of the diet, provides year-round access to a variety of fruits, and is a cost-effective way to help people meet fruit recommendations.

**Key findings:** Overall conclusion is that 100% fruit juice is associated with many health benefits, delivers essential nutrients and bioactives and plays an important role in helping individuals meet fruit recommendations without impact on energy intake or food costs.

[\*Socioeconomic gradient in consumption of whole fruit and 100% fruit juice among US children and adults\*](#)

Adam Drewnowski, PhD and Colin Rehm, PhD  
**Nutrition Journal.** January 2015; 14(3): 1-9.

Total fruit consumption falls far short of national goals, in fact, more than 85% of the population is not meeting recommended amounts. This study conducted at the University of Washington revealed that children and adolescents consumed less than one-half of a cup of 100% juice per day, (well below the Academy of Pediatrics 4-6 ounce serving size), whereas older adults consumed less than one-third of a cup.

It also found that general fruit consumption patterns show whole fruit provides about 65% (2/3'rds) of total fruit while 100% juice provides about 35% (1/3). Consumption patterns for whole fruit followed a socio-economic gradient among adults that was tied to education and income levels but this was not apparent for 100% juice consumption. Specifically, researchers found the people least likely to consume whole fruit were adults with low-incomes. With regard to race/ethnicity, non-Hispanic blacks were least likely to consume whole fruit. Both groups made up the fruit consumption shortfall with 100% juice.

**Key Findings:** Fruit juice is not overconsumed, does not displace fruit in the diet and falls into a pattern of two parts whole fruit, one part juice. Whole fruit is influenced by socioeconomics and this may pose challenges for the economically disadvantaged and some minority groups, whose fruit consumption falls short of national goals. For those segments of the population who are unable to afford whole fresh fruit, 100% fruit juice offers a convenient, affordable and nutrient-dense option that can help them meet recommended dietary goals and fill in the gaps.

[\*A review and critical analysis of the scientific literature related to 100% fruit juice and human health\*](#)

Dianne Hyson, PhD  
**Advances in Nutrition.** January 2015; 6: 37-51.

The current review conducted at the University of Southern California summarizes nearly two decades (1995-2012) worth of research data on 100% fruit juice and human health and provides evidence suggesting 100% juice contains bioactive components with the potential to positively affect human health. Specifically apple, cranberry, grape, grapefruit, orange, and pomegranate 100% fruit juice intake have been linked to protective effects on cancer, cardiovascular disease, cognition, hypertension, inflammation, oxidation, platelet function, urinary tract infection, and vascular reactivity.

**Key Finding:** Research review summarizing nearly two decades (1995-2012) worth of data suggests bioactives found in fruit juice may have the potential to have positive and possibly protective effects on human health.

## **DENTAL HEALTH**

### [100% Fruit Juice and Dental Health: A Systematic Review of the Literature](#)

DeAnn Liska PhD, Michael Kelley PhD and Eunice Mah PhD

**Frontiers in Public Health**, July 2019

This systematic review looked at eight publications representing five independent prospective cohort studies in children and adolescents and nine Randomized Clinical Trials (RCT) in adults.

**Key Findings:** The study concluded that the existing evidence on 100% fruit juice intake and caries and tooth erosion is not conclusive. The studies conducted on children and adolescents found *no association between 100% fruit juice and tooth decay or dental cavities*. These studies reflected normal intakes of juices and dental hygiene practices. While the results of the RCT's suggested a potential association, this data was primarily conducted using intra-oral devices and conditions that are not reflective of typical juice consumption. More research is necessary to reach definitive conclusions on this subject.

### [Longitudinal associations between children's dental caries and risk factors](#)

Oitip Chankanka, DDS, PhD; Joseph Cavanaugh, PhD; Steven Levy, DDS; et al.

**Journal of Public Health Dentistry**. Fall 2011; 71(4): 289-300.

Researchers followed 156 children in the Iowa Fluoride study from birth through 13 years of age. Researchers evaluated dental examinations at approximately ages 5, 9 and 13. Then they evaluated beverage exposure based on questionnaires sent to parents every 6 months since age 9.

**Key Findings:** Greater frequency of drinking 100% juice was related to fewer caries in children, indicating that 100% juice may have a protective effect on dental health. Researchers guessed that this could be due to (1) better quality diets and/or less cariogenic beverages, (2) anti-bacterial effects from the non-nutrients (bioactives or phytonutrients) found in certain juices (3) the different composition of sugars in 100% juices.

### [Early childhood caries and intake of 100 percent fruit juice: Data from NHANES, 1999-2004.](#)

Clemencia Vargas, DDS, PhD; Bruce Dye, DDS; Catherine Kolasny, BS; et al.

**Journal of the American Dental Association**. December 2014; 145(12): 1254-1261.

Dental researchers at the University of Maryland's School of Dentistry in Baltimore analyzed data from the 1999-2004 National Health and Nutrition Examination Survey (NHANES) for 2,290 preschool children aged 2 through 5 years. They used logistic models for caries to assess the association between caries and intake of 100 percent fruit juice,

**Key Findings:** Researchers found no association between intake of 100% fruit juice and early childhood caries (ECC). These results are consistent with those of other studies and show that consumption of 100% fruit juice is not associated with early childhood caries.

[\*Factors associated with early childhood caries incidence among high caries-risk children\*](#)

Tariqu Ghazal, DDS; Steven Levy, DDS, MPH

**Community Dentistry and Oral Epidemiology.** August 2015; 43(4): 366-374.

Ninety-six African-American children aged 3–22 months old at baseline were recruited from a high caries risk, non-fluoridated African-American community in Alabama. The children had dental examinations annually following World Health Organization (WHO) criteria at mean ages 1.1, 2.0, 3.1 and 4.0 years. All children received fluoride varnish application at each study visit. Parents provided oral hygiene and dietary information semiannually by completing questionnaires.

**Key Findings:** Frequent consumption of 100% juice (more than two times per day) among young children was associated with lower incidence of early childhood dental caries.

[\*Association of healthy eating, juice consumption, and bacterial counts with early childhood caries\*](#)

Wafaa Abdelaziz, PhD; Karin Dowidar, PhD; Maha El Tantawi, PhD

**Pediatric Dentistry.** Sept/Oct. 2015; 37(5): 462-467.

**Key Findings:** This small study conducted in Egypt supports other research which shows drinking 100% juice is not associated with early childhood cavities in preschool children and, in fact, is associated with lower rates of caries in children. It also supports research showing that children who drink juice have higher Healthy Eating Index scores than children who do not drink juice.