Artificial Sweetener Consumption and Children's Health: Key Considerations for Nutrition Policy

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Consequences of excess added sugar intake

Excess added sugar intake has negative impacts on health.

- Overweight and obesity
- Type 2 diabetes
- Non-alcoholic fatty liver disease
- Cardiovascular disease
- Dental caries

Sugar-sweetened beverages (SSBs) are the greatest contributors to added sugar intake in the US.

Malik VS et al., J Am Coll Cardiol, 2015


A can (12 FL OZ) of
regular soda has about
150 CALORIES AND
10 TEASPOONS
of added sugar.


STOP. RETHINK YOUR DRINK.
GO ON GREEN.
Red - Drink Rarely, If At All
- Regular sodas
- Energy or sports drinks
- Fruit drinks
Yellow - Drink Occasionally
- Diet soda
- Low-calorie, low-sugar drinks
- 100% juice
Green - Drink Plenty
- Water
- Seltzer water
- Skim or 1% milk
BOSTON PUBLIC HEALTH COMMISSION


ARE YOU POURING ON THE POUNDS?
DON'T DRINK YOURSELF FAT.
Cut back on soda and other sugary beverages.
Go with water, seltzer or low-fat milk instead.
NYC


HEALTHY KIDS ARE SWEET ENOUGH
Heart Healthy Tip: NO MORE THAN 1 Sugary Drink a Week
How many teaspoons of sugar in just one SMALL 8 OUNCE serving?
WATER
0 TSPS
SPORTS DRINK
4 TSPS
SWEET TEA
6 TSPS
SODA
6 TSPS
LEMONADE
7 TSPS
Learn more at heart.org/sugar
Source: USDA National Nutrient Database for Standard Reference Release 28
American Heart Association.

DRIVING CHOICE & REDUCING SUGAR

“We removed nearly 125,000 tons of added sugar through recipe changes in 2020.”

“About 36% of our beverage portfolio is low- or no-sugar.”

Bandy *et al. BMC Medicine* (2020) 18:20
https://doi.org/10.1186/s12916-019-1477-4

BMC Medicine

RESEARCH ARTICLE Open Access

Reductions in sugar sales from soft drinks in the UK from 2015 to 2018

L. K. Bandy[1*], P. Scarborough[1], R. A. Harrington[1], M. Rayner[1] and S. A. Jebb[2]

"The total volume sales of soft drinks that are subject to the soft drink industry levy (SDIL) fell by 50%, while the volume sales of low- and zero-sugar (<5 g/100 ml) drinks rose by 40%."

nutrients

MDPI

Article

Reformulation of Packaged Foods and Beverages in the Colombian Food Supply

Published
October 2020

Caitlin M. Lowery [1], Mercedes Mora-Plazas [2], Luis Fernando Gómez [3], Barry Popkin [1,4] and Lindsey Smith Taillie [1,4,*]

"No meaningful changes in the quantities of nutrients of concern were observed. Our findings suggest little reformulation has occurred in Colombia in the absence of mandatory policies, **except for the substitution of sugar with non-nutritive (artificial) sweeteners among beverages."**

PEPSICO

Hankering for a Pepsi but looking to cut some calories? **Try the full cola taste of Pepsi Next made with 60% less sugar**. Love your Gatorade but not the calories? **Try G2 with the same electrolyte formula and 60% fewer calories.** Like to start your day with a glass of Tropicana Orange Juice but watching your waistline? **Try Trop50.** You get the picture. There's a low calorie option for virtually every drink we make. The choice is yours.

https://www.pepsicobeveragefacts.com/home/caloriebalance

PEPSICO

15 g added sugar + sucralose, acesulfame-potassium & aspartame

7 g added sugar + sucralose & acesulfame-potassium

10 g sugar + stevia leaf extract

Added sugars + artificial sweeteners

- Used Nielsen data to identify beverage brands that spent at least $100,000 in advertising and contain added sugar

- Excluded “children’s drinks,” which were previously reported.

- Many brands offered products that contained artificial sweeteners **<u>IN ADDITION</u>** to added sugars, including:

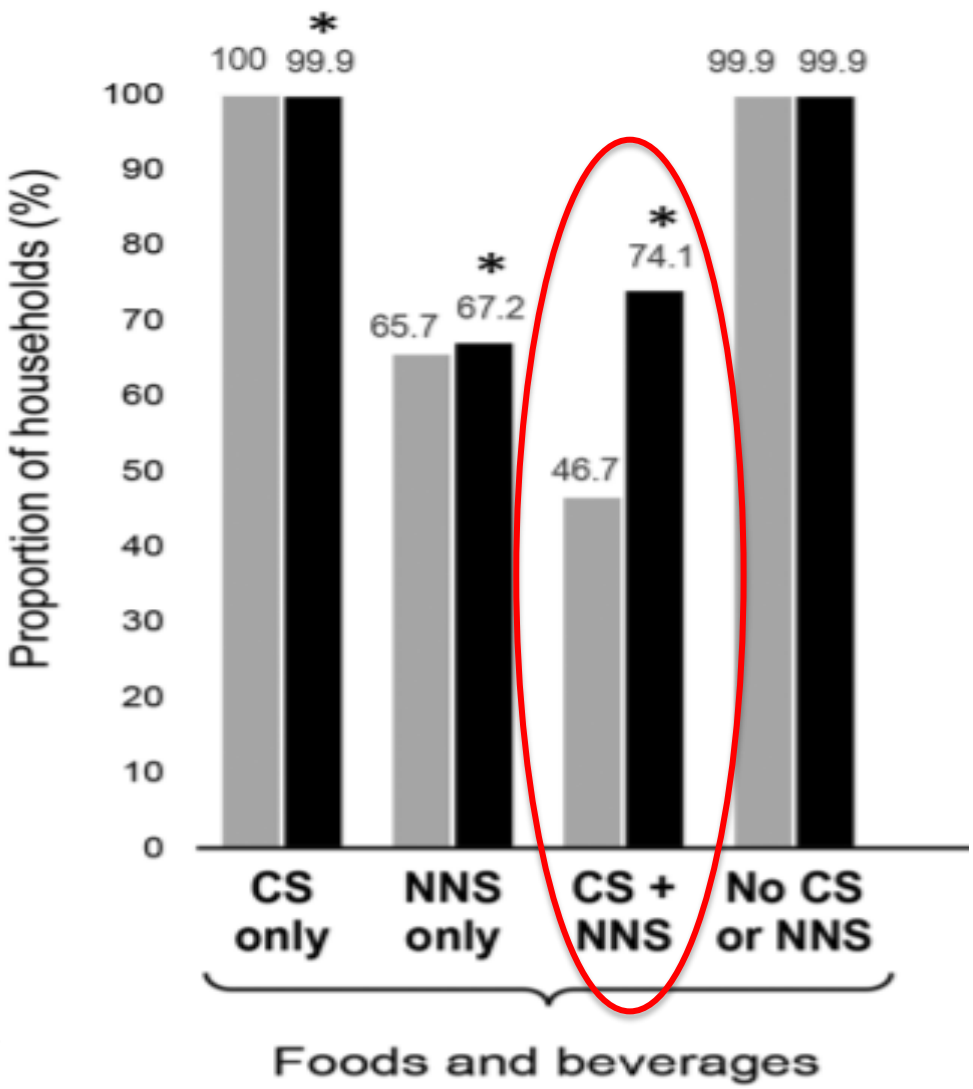
  - 88% of energy drinks,
  - 40% of iced teas,
  - 30% of fruit drink, sports drinks, and regular sodas

Yale Rudd Center, “Sugary Drink Facts” 2020

Proportion of household purchases with NNS

N = 39,300 households in 2002

N = 61,101 households in 2018



Dunford et al. JAND 2020

What about artificial sweeteners?

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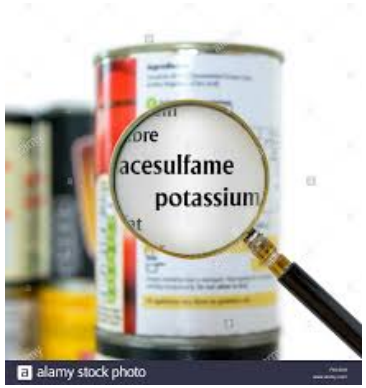
Are they helpful or harmful for weight management and prevention of chronic disease?

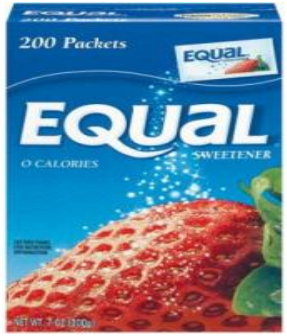
Commonly used artificial sweeteners

FDA approved as food additives

Sucralose
600x



Acesulfame-K
200x



Aspartame
160-220x

Saccharin
300x

Common plant-based, non-caloric sweeteners

Stevia, Rebaudioside A **Monk Fruit (luo han guo)**

Considered to be generally recognized as safe (GRAS)

I will collectively refer to them as "low-calorie sweeteners (LCS)"

Widespread presence of products with LCS

Sylvetsky, & Dietz 2014
Sylvetsky et al., Int. J Peds, 2014

Products with LCS marketed to children

Sylvetsky & Dietz, NEJM 2014; Sylvetsky et al. 2021 (in prep)

Pediatric OBESITY
WORLD OBESITY

ORIGINAL RESEARCH

Misperceptions about added sugar, non-nutritive sweeteners and juice in popular children's drinks: Experimental and cross-sectional study with U.S. parents of young children (1-5 years)

Jennifer L. Harris, Jennifer L. Pomeranz

First published: 07 April 2021 | https://doi-org.proxygw.wrlc.org/10.1111/ijpo.12791

N= 1603 parents of young children through an online survey

In a randomized experiment, parents asked to indicate whether 8 popular children's drink products contained LCS after viewing:

- front-of-package alone or
- front-of-package plus nutrition/ingredient information.

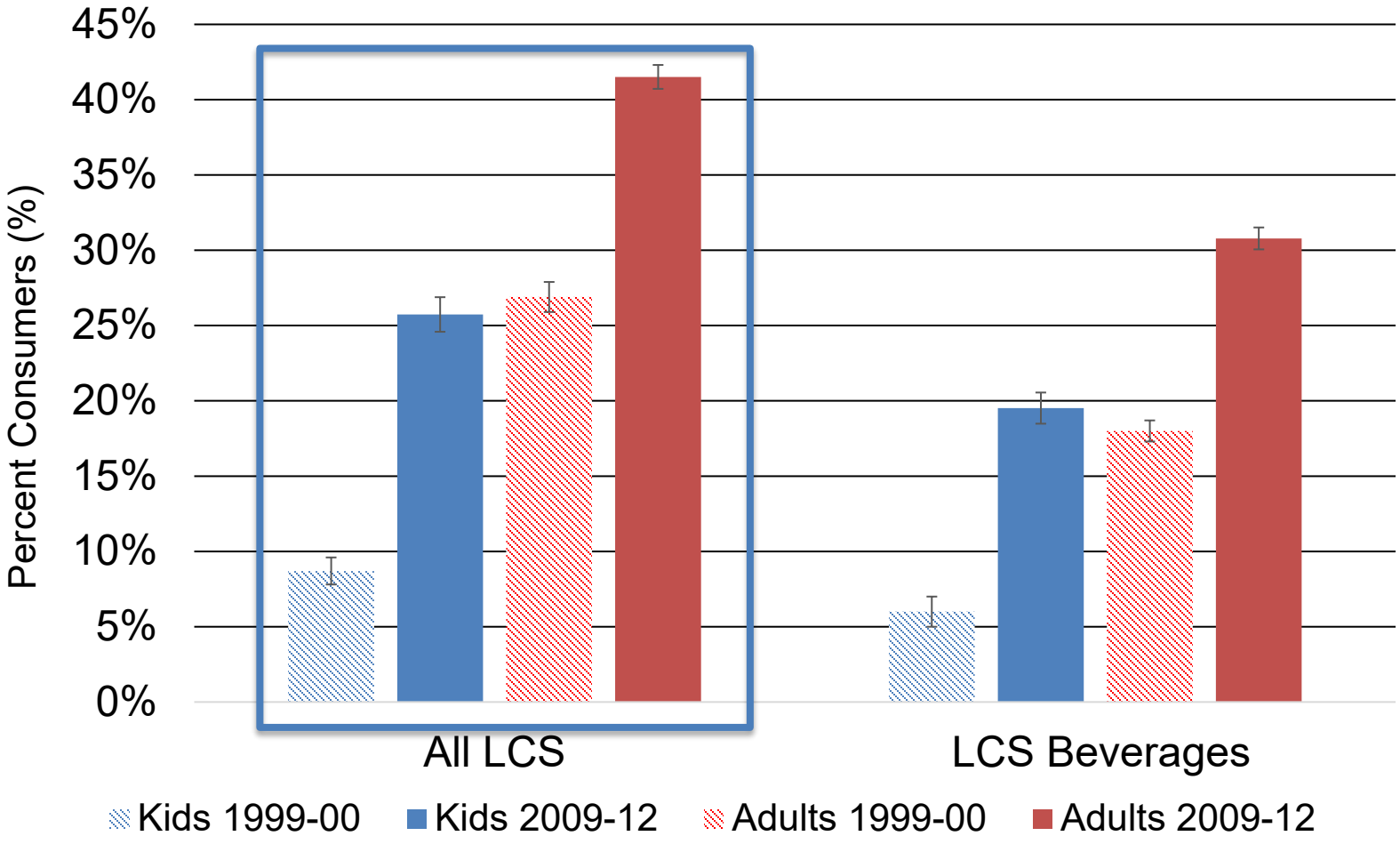
The majority of parents could not identify drinks with LCS!
…even when nutrition/ingredient information was presented.

42% with info
39% without

46% with info
38% without

Harris & Pomeranz, Pediatric Obesity 2021

LCS consumption in the United States



Sylvetsky AC, Welsh JA, Vos MB et al. AJCN 2012; Sylvetsky AC, Welsh JA et al. J Acad Nutr Diet 2017

Demographic correlates of LCS consumption

- LCS intake more prevalent among:
  - Adults compared with children
  - Individuals who self-identify as non-Hispanic white
  - Individuals from higher SES households
  - Individuals of higher body mass index (BMI)
  - Individuals with diabetes

Sylvetsky & Rother Phys & Behavior 2016

Prevalence of consumption is underestimated

- Lack of consumer awareness about foods and beverages that contain LCS.

Prevalence of consumption is underestimated

- Challenges with food code groupings in dietary databases.
- EXAMPLE: FNDDS 2015-2016, Food code: 92530610
  - Main description: “Fruit juice drink, with high Vitamin C”
  - Additional food code description includes the following brands:

No LCS

Sucralose

Sucralose + ace-K

Sucralose

No LCS

Swithers, Welsh & Sylvetsky et al. Nutrients 2021

Consumption estimates are inherently flawed

- Lack of information regarding specific LCSs
- Manufacturers not required to indicate the amount per serving

11460200	Yogurt, frozen, chocolate, nonfat milk
11460250	Yogurt, frozen, flavors other than chocolate, with sorbet or sorbet-coated
11460300	Yogurt, frozen, flavors other than chocolate, nonfat milk
11460400	Yogurt, frozen, chocolate, nonfat milk, with low-calorie sweetener
11460410	Yogurt, frozen, flavors other than chocolate, nonfat milk with low-calorie sweetener
11460420	Yogurt, frozen, NS as to flavor, whole milk

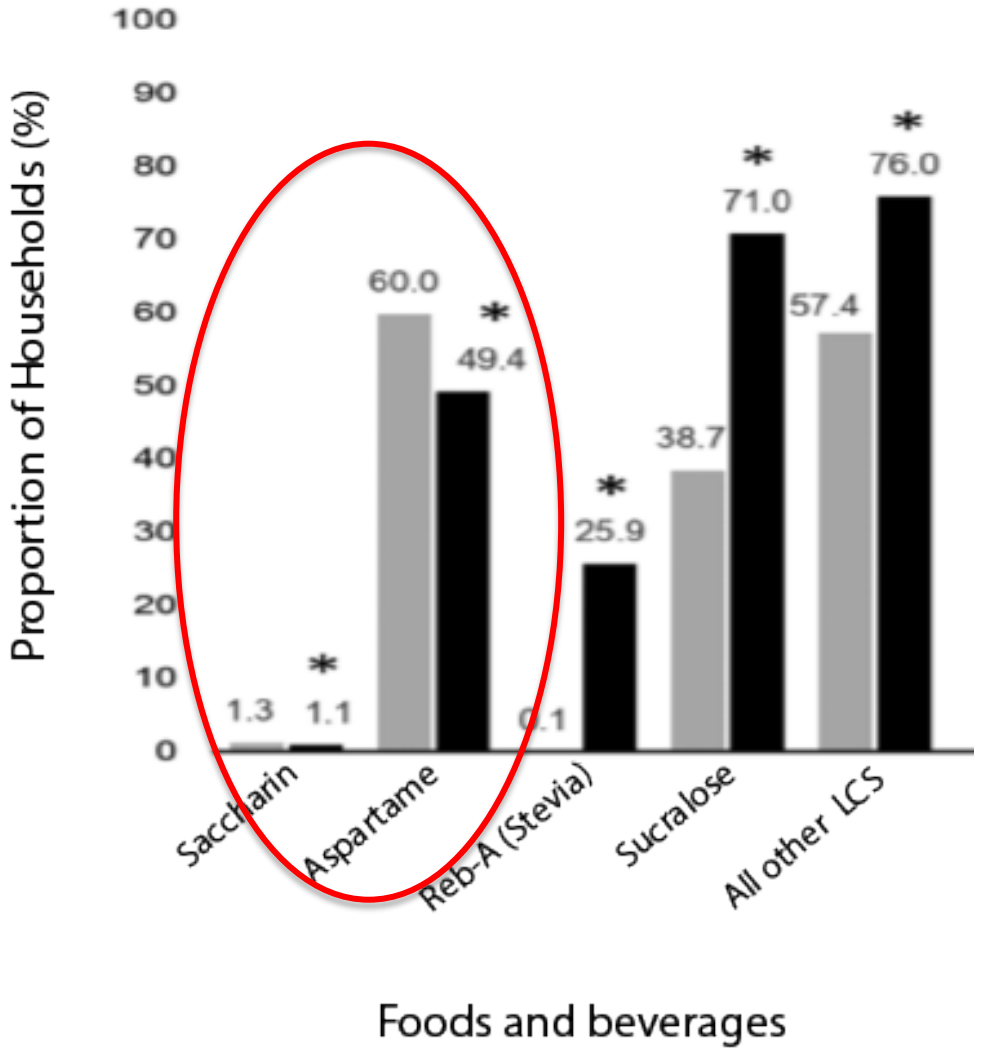
Total Carbohydrate 8g	3 %
Total Sugars 7g	

Ingredients
Water, Sugar, Citric Acid, Salt, Sodium Citrate, Natural An
Artificial Flavor, Monopotassium Phosphate, Sucralose,
Red 40, Acesulfame Potassium.

Swithers, Welsh & Sylvetsky et al. Nutrients 2021

Purchases by type of LCS

- ↓ Saccharin, aspartame
- ↑ Stevia/RebA
- ↑ Sucralose
- ↑ Other LCS



Dunford et al. JAND 2020

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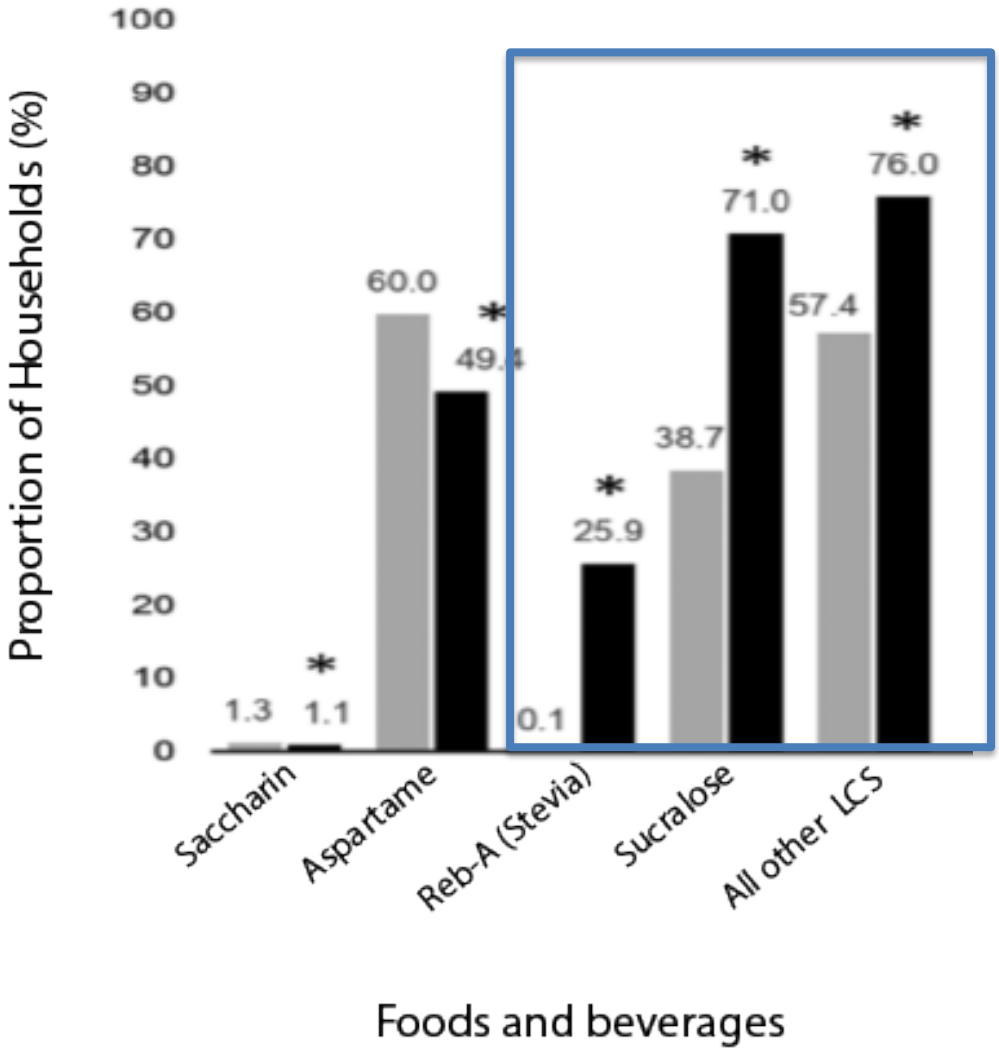

Dunford et al. JAND 2020

2020-2025 Dietary Guidelines

"It should be noted that replacing added sugars with low- and no-calorie sweeteners may reduce calorie intake in the short-term and aid in weight management, yet questions remain about their effectiveness as a long-term weight management strategy."

"Low- and no-calorie sweeteners, which can also be called high-intensity sweeteners, are not recommended for children younger than age 2. Taste preferences are being formed during this time period, and infants and young children may develop preferences for overly sweet foods if introduced to very sweet foods during this timeframe."

Low-Calorie Sweetened Beverages and Cardiometabolic Health

A Science Advisory From the American Heart Association

'There is a **scarcity of long-term RCTs** of sufficient sample size and duration to adequately document the efficacy and safety of LCS beverages, particularly relative to SSBs, as a tool to help maintain energy balance, control cardiometabolic risk factors, and reduce risk of cardiovascular events. This **lack of evidence** does not mean that LCS beverages are or are not efficacious…Nonetheless, there is a dearth of evidence on the potential adverse effects of LCS beverages relative to potential benefits. On the basis of the available evidence, the writing group concluded that, at this time**, it is prudent to advise against prolonged consumption of LCS beverages by children**.'

Johnson et al. 2018 Circulation


55% LESS SUGAR
Kool-Aid Jammers
TROPICAL PUNCH


NO artificial flavors
Crystal Light
LIQUID
STRAWBERRY LEMONADE
DRINK MIX
0 CALORIES


Little HUG
Fruit Barrels


HAWAIIAN PUNCH


NO ARTIFICIAL SWEETENERS
NO HIGH FRUCTOSE CORN SYRUP
NO ARTIFICIAL COLORS, FLAVORS OR PRESERVATIVES
CAPRI SUN
TROPICAL FRUIT
ROARIN' WATERS
FLAVORED WATER BEVERAGE


TWISTER
light
fruit punch


BERRY BLUE TYPHOON
SUGAR FREE
HAWAIIAN PUNCH
Singles to go!
Add to bottled water
8 Packets


CREATIVE ROOTS
NEW
1 GRAM SUGAR
Mixed Berry
FLAVORED COCONUT WATER BEVERAGE


Hi-C
50% LESS SUGAR
FEWER CALORIES
100% Vitamin C
POPPIN' LEMONADE
40 CALORIES PER MIX


good2grow
CHARACTER 3 PACK
NO SUGAR ADDED
75% LESS SUGAR
Fruit Fusion


MAKES 24 8 FL OZ SERVINGS
Kool-Aid
Liquid
TROPICAL PUNCH
0 CALORIES

Reformulation of products to contain LCS

Analysis of ~1500 products from 19 supermarkets from Dec 2018-Oct 2019

55% contained at least one LCS

100% of flavored waters; 99% of powdered juices, 98% of flavored milks

frontiers in Nutrition

ORIGINAL RESEARCH
published: 17 June 2020
doi: 10.3389/fnut.2020.00068

Check for updates

Published in June 2020

Overuse of Non-caloric Sweeteners in Foods and Beverages in Chile: A Threat to Consumers' Free Choice?

Verónica Sambra[1], Sandra López-Arana[1], Paola Cáceres[1], Karen Abrigo[1], Javiera Collinao[2], Alexandra Espinoza[2], Sabrina Valenzuela[2], Bielka Carvajal[3], Gabriel Prado[1], Rebeca Peralta[1] and Martin Gotteland[1,4]**

[1] Department of Nutrition, Faculty of Medicine, University of Chile, Santiago, Chile, [2] Faculty of Medicine, School of Nutrition and Dietetics, University of Chile, Santiago, Chile, [3] Department of Women and Newborn's Health Promotion, Faculty of Medicine, University of Chile, Santiago, Chile, [4] Human Nutrition Unit, Institute of Nutrition and Food Technology (INTA), University of Chile, Santiago, Chile

"The fact that there are no LCS-free alternatives for certain food categories, especially for children, is worrying."

Guidance highlights uncertainty…

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What do we know about whether LCS are helpful or harmful for weight management and prevention of chronic disease?

LCS vs sugar in randomized controlled trials

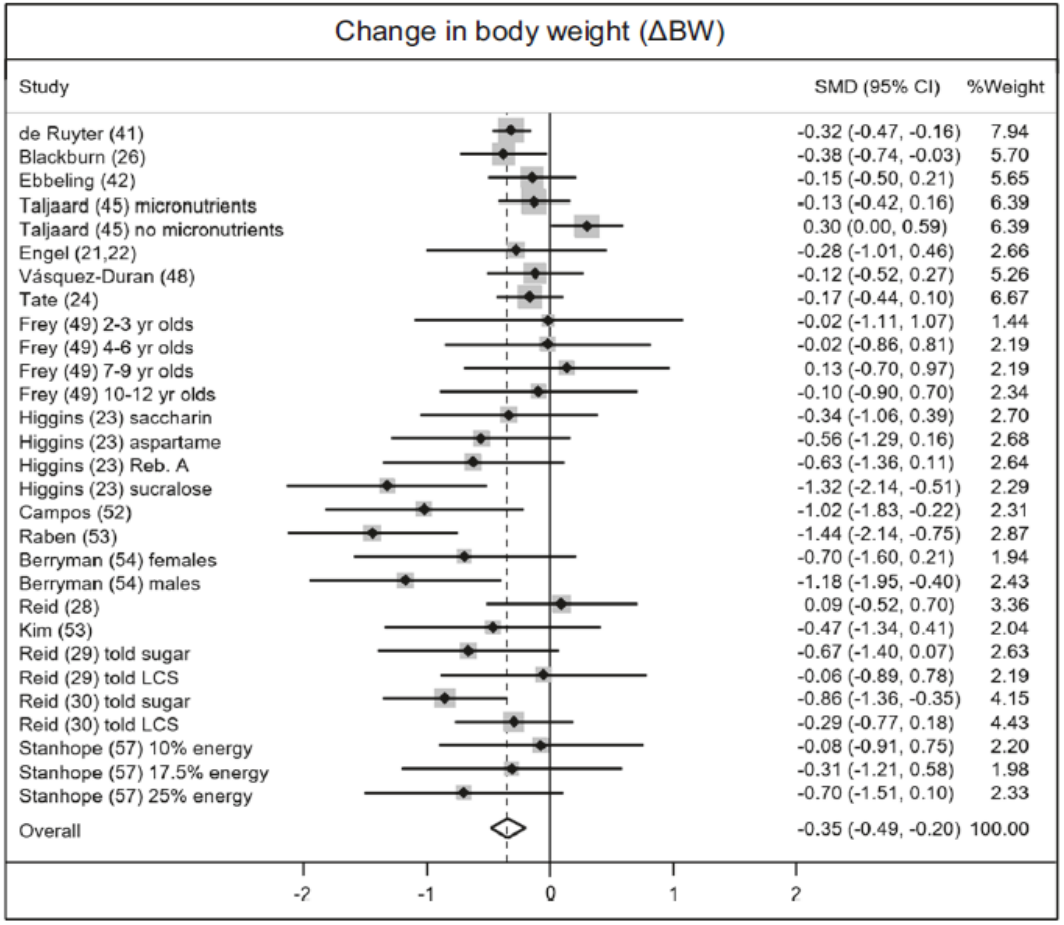
N= 29 parallel-arm RCTs

Included children and adults

2267 participants

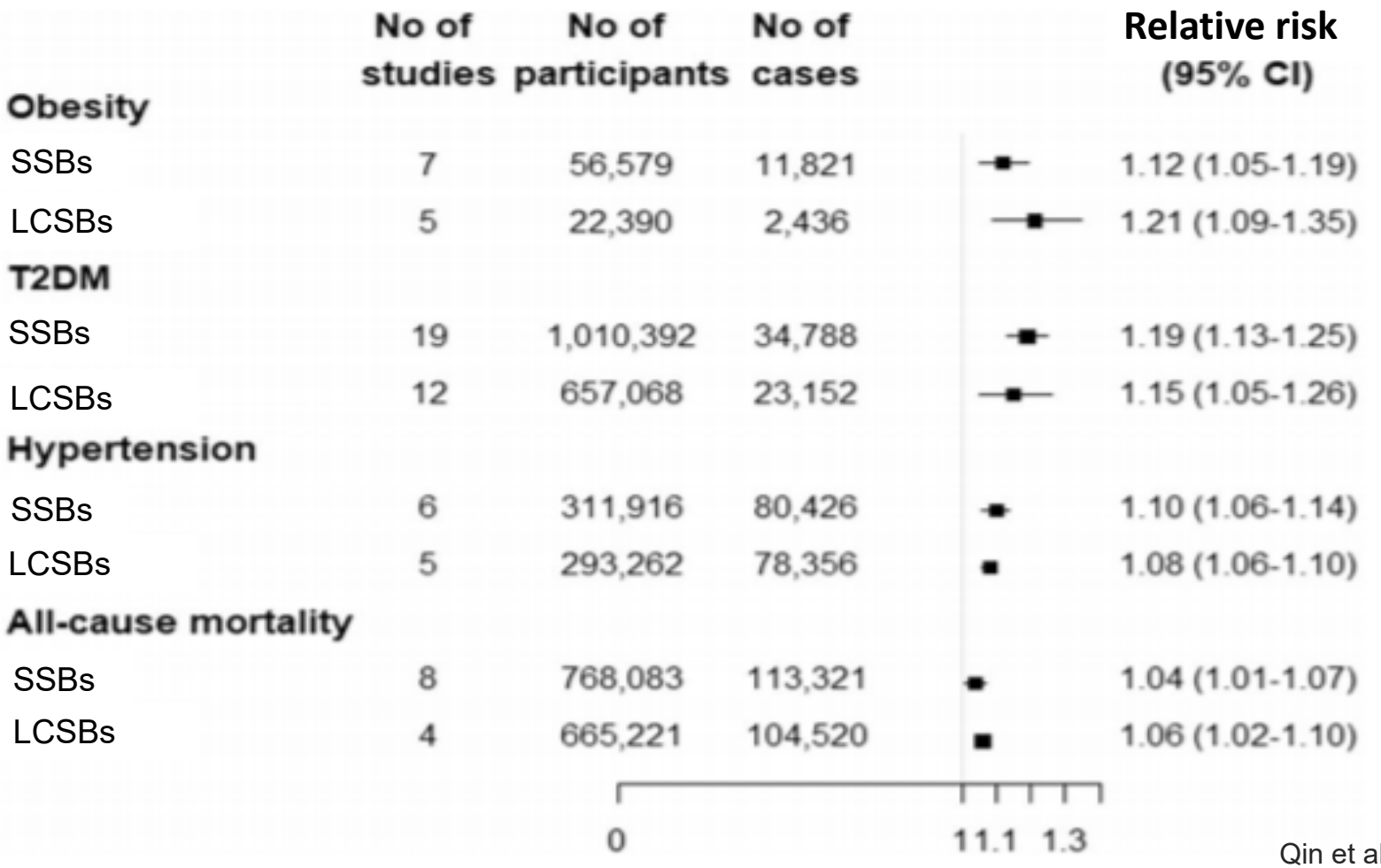
Results show favorable effect of LCS vs sugar

Reduction of ~1.06 kg



Rogers & Appleton, Int J Obes 2021

Cohort studies tell a different story

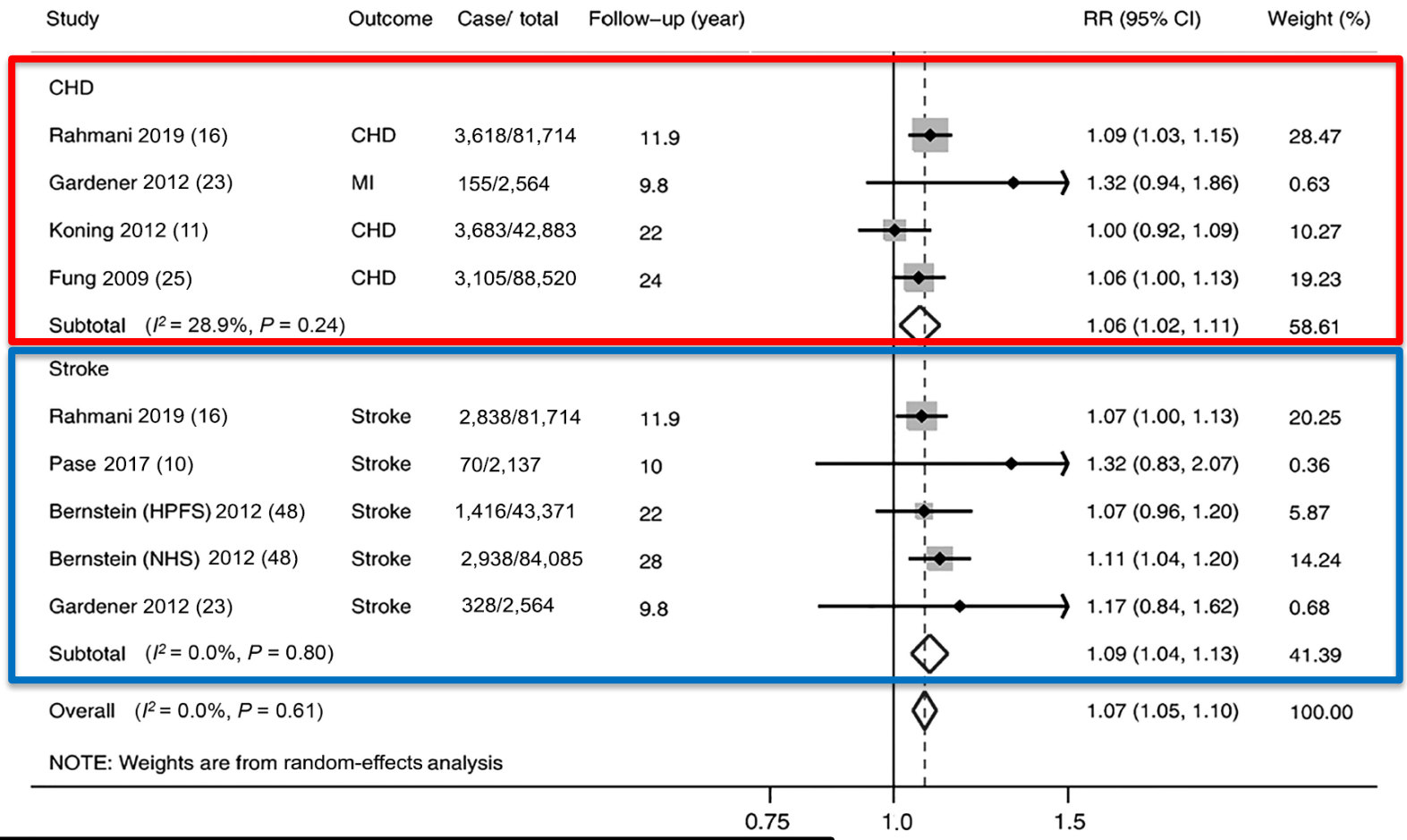


**Per 1 serving (250 mL) of LCS beverages per day

Qin et al. Eur J Epid. 2020

7% higher CVD risk per 1 serv of LCSBs/day

Risk of CVD per 1 serving (250 mL) of LCS beverages per day



Overall RR 1.07 for LCSBs; Overall RR 1.08 for SSBs

Yin et al. Adv. Nutr 2021

Very few RCTs have focused on cardiometabolic outcomes other than weight or adiposity

The vast majority have been conducted in healthy individuals

The vast majority have been conducted in adults

How to explain discrepant findings?

Developing obesity, being overweight, already at risk for cardiometabolic disease

Discrepant results: behavioral mechanisms

Real-life

Unaware of LCS use
No behavioral support/weight loss diet
Low cognitive engagement
Substitution vs. addition?
LCS from many sources

VS

RCT

Knowledge of LCS consumption
Intensive behavioral support
High cognitive engagement
Diet beverages/capsules
Relatively short timeframe

Sylvetsky et al. Reviews in Endocrinology and Metabolic Disorders 2017

LCS and health: biological mechanisms

Sweet-taste receptor mediated changes in glucose and insulin

Increased adipogenesis, disturbance of pathways in adipose

Alterations in gut microbiota

?

↑ Cardiometabolic Risk Factors

Impaired predictive relationship between sweet taste and calories

Change in taste preferences, dietary patterns

Summary: what we know

- Presence of LCS in the food supply has increased, especially in products that also contain added sugars.
- LCS consumption has increased in the US and worldwide, particularly among children.
- Discrepant findings of RCTs vs. observational studies of LCS effects on body weight and cardiometabolic outcomes
- 1:1 replacement of SSBs with diet beverages may be effective for weight loss strategy in adults who frequently consume SSBs.
- LCS induce metabolic derangements in rodents, but unclear relevance to human consumption.

Summary: what we don't know

- Scarcity of RCTs on metabolic outcomes other than weight
- Difficult to disentangle effects due to specific LCS
- Very limited research on metabolic effects of stevia
- Little known about real-life consumption patterns/effects of LCS from sources other than diet beverages
- Most studies conducted in healthy individuals
- Extremely limited research in children and adolescents
- Early life/intergenerational exposure not well understood

Implications for nutrition research & policy

- Change regulation of front of package claims to support informed consumer decision making.
- Consider label calling attention to LCS in products marketed directly to children.

- Restrict advertising of both SSBs and LCSBs to youth.
- Require manufacturers to disclose the amount of LCS in order to estimate LCS exposure.
- Update dietary databases to accurately reflect presence of LCS in foods and beverages.

Implications for sugar reduction messaging

- Water and unsweetened beverages are best!
- Beverages with LCS may offer a weight management option among adults who consume SSBs, if used carefully.
- Efforts to reduce added sugar in foods should focus on reducing sweetness and choosing healthier options, rather than adding LCS.
- LCS should not be used in products marketed to children.

THANK YOU!