



# What should I drink?

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ECHO Diabetes Learning Group  
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# Learning Objectives

Describe relationship between added sugar and sugar sweetened beverages intake and health

Differentiate fructose metabolism and subsequent effect on metabolic disease risk

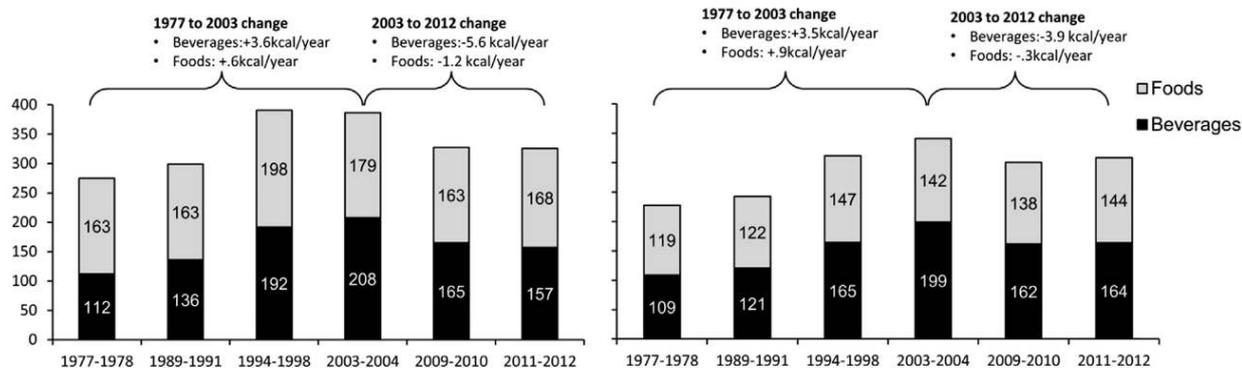
Identify healthy beverage alternatives to sugar sweetened beverages

# What's a sugar-sweetened beverage (SSB)?

- Soft drinks or soda
- Fruit drinks
- Energy drinks
- Any drink where the manufacturer adds sucrose, high-fructose corn syrup, (HFCS) or other nutritive sweetener

# SSB Contribution to Total Energy intake

- Adults consume about 14% of daily energy from added sugar
  - Children 17%
- Sharp increase from 1977-2003 and decline from 2003-2012
- Decline in intake is even across all groups (high consumers and low consumers)



**Figure 1.** Adjusted mean calories of daily added sugars consumed by (left panel) children aged 2 to 18 years in the United States and (right panel) by adults aged 19 years and up in the United States from 1977 to 2012 for foods and beverages, adjusted by sex, race, income and education, weighted to be nationally representative.

**Table 1.** Percentage of uniquely formulated consumer packaged food products purchased during 2005-2009 by sweetener category for select food groups<sup>a</sup>

Select food or beverage group	No. of unique products	% Among all unique products	% Unique Products within Food Group <sup>b</sup> Containing			
			No sweetener	CS <sup>c</sup> (including FJC <sup>d</sup> ) only	NCS <sup>e</sup> only	Both CS and NCS
Infant food, formula	993	1.2	47.5	52.5	0.0	0.0
Cakes, cookies, pies	5,592	6.5	0.7	95.3	0.1	4.0
Fruit, fresh, frozen, canned, or dried	1,722	2.0	36.6	59.9	2.7	0.7
Granola, protein, or energy bars	2,526	3.0	3.0	78.2	0.0	18.8
Ready-to-eat cereals	1,378	1.6	3.6	94.0	0.3	2.1
Salad dressings and dips	3,305	3.9	26.9	71.0	1.5	0.7
Savory snacks	5,734	6.7	28.8	69.9	0.7	0.6
Sweet breads and pastries	1,440	1.7	17.3	79.3	0.5	2.9
Sweet snacks	6,710	7.9	0.6	84.6	0.6	14.1
Yogurt	1,152	1.3	6.4	60.8	6.8	26.0
Sport and energy drinks	506	0.6	1.2	63.4	6.9	28.5
Sugar-sweetened beverage	2,513	2.7	1.5	83.6	1.0	13.9
Dietetic sweetened beverage <sup>f</sup>	974	1.4	9.9	17.2	14.6	58.3
Milk and milk/yogurt/soy drinks	1,483	1.7	32.4	56.6	2.4	8.6
100% Fruit juice	1,404	1.6	33.6	66.0	0.0	0.4
Vegetable juice	230	0.3	22.2	69.1	0.4	8.3
Water, plain or flavored	799	0.9	36.4	21.7	22.3	19.7
All food and beverage groups	85,451	100	25.4	67.9	1.0	5.6

# SSB Products

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67% of the different foods purchased contained some type of caloric sweetener or fruit juice concentrate

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# SSB Products

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7,110 (8%) unique SSBs were purchased!

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*Large proportion of these products contain some type of added sweetener*

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# SSB Consumption

## Regional differences in level of consumption & type of SSB

**Table 3.** Adjusted odds ratios (aORs) and 95% CIs for frequency of total sugar-sweetened beverages (SSBs)<sup>a</sup> consumption and type of SSBs consumed during the past month among US adults, based on data from the National Health Interview Survey, 2010<sup>b</sup>

Region of residence	Total SSB ≥1 time/d	Type of SSB			
		Regular sugar-sweetened carbonated beverage ≥1 time/d	Fruit drink ≥1 time/d	Sports and energy drink ≥1 time/d	Sweetened coffee/tea drink ≥1 time/d
		← aOR (95% CI) →			
Northeast	1.13 (1.01-1.26) <sup>c</sup>	0.51 (0.45-0.57) <sup>c</sup>	1.01 (0.84-1.22)	0.91 (0.74-1.11)	1.60 (1.43-1.78) <sup>c</sup>
Midwest	0.70 (0.64-0.78) <sup>c</sup>	0.86 (0.78-0.96) <sup>c</sup>	0.84 (0.71-1.00)	0.85 (0.72-1.02)	0.70 (0.62-0.78) <sup>c</sup>
South	Reference	Reference	Reference	Reference	Reference
West	0.78 (0.71-0.87) <sup>c</sup>	0.56 (0.51-0.62) <sup>c</sup>	0.95 (0.79-1.14)	0.77 (0.64-0.93) <sup>c</sup>	0.93 (0.84-1.02)

<sup>a</sup>Total SSB includes regular sugar-sweetened carbonated beverages, fruit drinks, sports/energy drinks, and sweetened coffee/tea drinks.

<sup>b</sup>The multivariable logistic regression model for each SSB included 25,299 adults and controlled for age, sex, race/ethnicity, marital status, education, and annual household income. The reference group was <1 time/day.

<sup>c</sup>Significant findings based on the 95% CI (ie, the CI does not include 1).

# SSB Consumption: Knowledge & Intake Levels

- 4163 US adults included in a National survey
- 37.8% reported having  $\geq 2$  SSBs/day
- Respondents aware that SSBs are related to
  - Weight gain (80%)
  - Diabetes (73%)
  - Cavities (72%)
  - High Cholesterol (24%)
  - Heart Disease (31%)
  - Hypertension (33%)
- Lack of knowledge on association between SSB and heart disease increased odds for  $\geq 2$  SSBs/day, no significant influence of knowledge on any other intake level
- Take home reminder: Knowledge  $\neq$  Behavior Change

# What's the problem with these drinks?

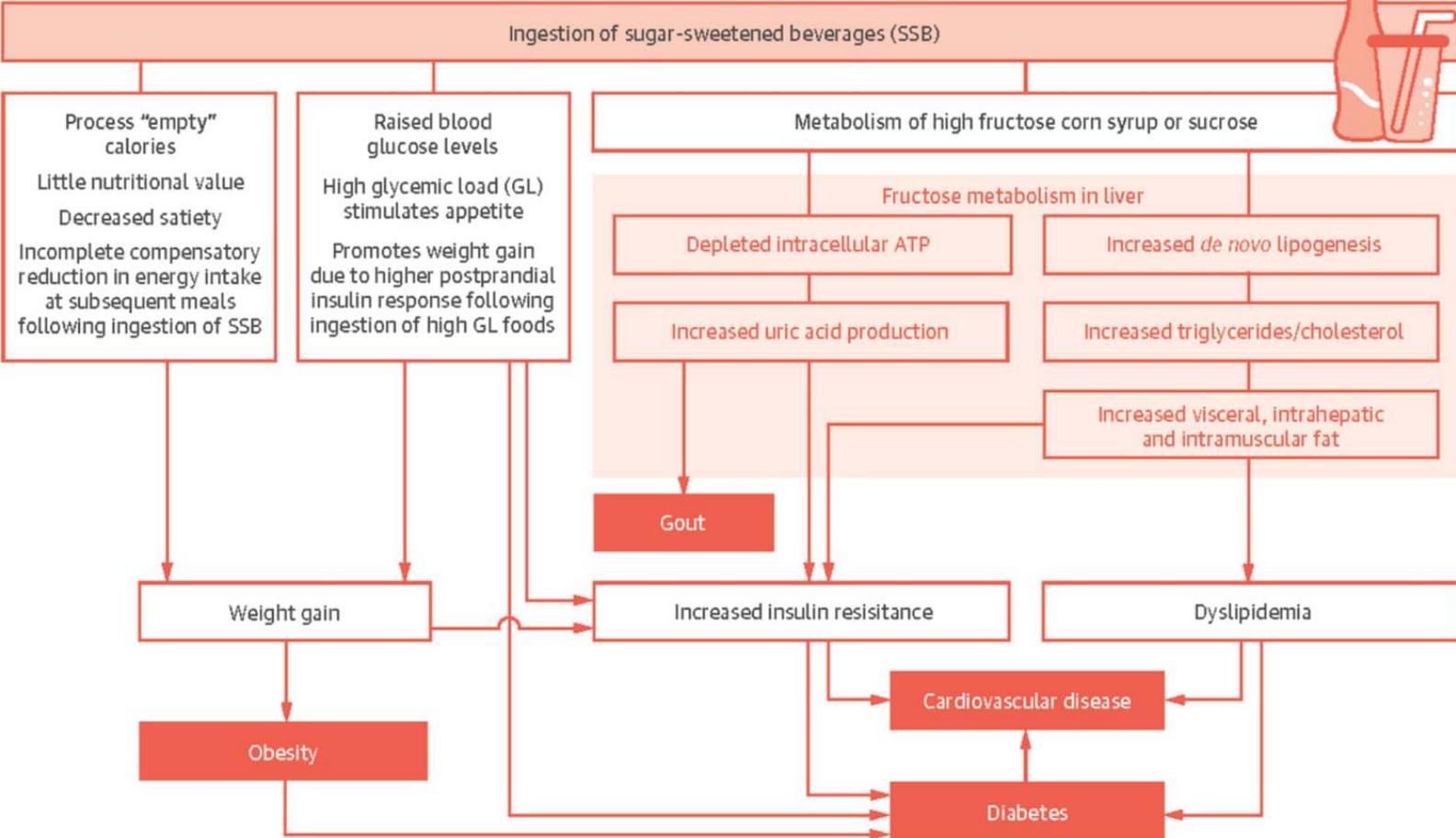
Overconsumption is the concern (of added sugar)

- Associated with poor diet quality, increased energy intake, CVD mortality, dental caries
- SSBs often contain few nutrients but are energy-dense

Beverages primary target as energy/calories consumed from these drinks are not compensated for by reduced food intake

- They don't make us feel full, keep us full, or stop us from eating later

# A closer look at SSBs & fructose



Malik VS & Hu FB. (2016). Fructose and cardiometabolic health: what evidence from sugar-sweetened beverages tells us. *J Am Coll Cardiol*: 66(14), 1615-1624.

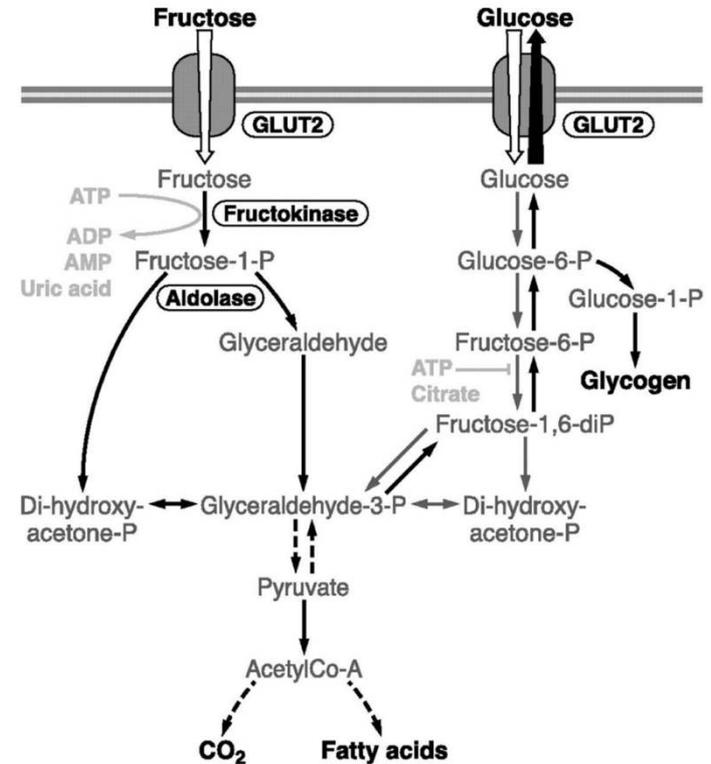
# Common Sweeteners Found in Beverages

**Table 3.** Most common sweeteners used in unique consumer packaged food products purchased during 2005 through 2009 for select food groups<sup>a</sup>

Select food or beverage group	Most common	Second most common	Third most common	Fourth most common	Fifth most common
Infant food, formula	Corn syrup	FJC <sup>b</sup>	Lactose	Sorghum	Cane
Cakes, cookies, pies	HFCS <sup>c</sup>	Sorghum	Corn syrup	Cane	Molasses
Fruit, fresh, frozen, canned, or dried	HFCS	Cane	FJC	Corn syrup	Sucralose <sup>d</sup>
Granola, protein, or energy bars	Sorghum	Cane	Corn syrup	Honey	Alcohol
Ready-to-eat cereals	Sorghum	Cane	Honey	Corn syrup	Molasses
Salad dressings and dips	Corn syrup	FJC	Cane	Sorghum	HFCS
Savory snacks	Sorghum	Corn syrup	Cane	HFCS	Lactose
Sweet breads and pastries	Sorghum	Corn syrup	Cane	HFCS	Honey
Sweet snacks	Corn syrup	Sugar alcohol	Sorghum	Lactose	Honey
Yogurt	HFCS	Fructose	Aspartame <sup>d</sup>	Sucralose <sup>d</sup>	FJC
Sport and energy drinks	Cane	Sucrose	HFCS	Sucralose <sup>d</sup>	Corn syrup
Sugar-sweetened beverage	HFCS	FJC	Cane	Corn syrup	Fructose
Dietetic sweetened beverage <sup>e</sup>	Acesulfame potassium <sup>d</sup>	Aspartame <sup>d</sup>	Sucralose	Cane	FJC
Milk and milk/yogurt/soy drinks	Corn syrup	Cane	HFCS	Sucralose <sup>d</sup>	Sorghum
100% fruit juice	FJC	HFCS	Cane	Fructose	Sorghum
Vegetable juice	FJC	HFCS	Sucralose <sup>d</sup>	Cane	Fructose
Water, plain or flavored	Sucralose <sup>d</sup>	Acesulfame potassium <sup>d</sup>	Fructose	Cane	Sugar alcohol
All food and beverage groups	Corn syrup	Sorghum	Cane	HFCS	FJC

# Glucose vs. Fructose Metabolism & CVD Risk

- Fructose metabolism occurs quickly in the liver (almost exclusively)
- High intakes of fructose yields substrate for triglyceride production and leads to increases in visceral fat, lipid dysregulation, decreased insulin sensitivity



# More About SSBs

- SSB is related to weight gain/obesity, metabolic syndrome, fatty liver disease
- Across genders, effect of SSB on weight gain is greater in women
- A study of 120,000 adults found that with an increase in 12 oz of SSB gained on average 1 extra pound every 4 years
- Genetic risk is implicated where individuals predisposed to obesity are more likely to become obese when they drink SSBs vs. those who do not consume

# Replacement Beverages- Artificially sweetened beverages (ASB)

- Proposed that these sweeteners bind to sweet-taste receptors that trigger intestinal enzyme secretion to lower blood sugar → insulin secretion → increase appetite → promote weight gain (Egan & Margolskee, 2008)
- May also have negative effects on gut microbiota that could contribute to glucose intolerance (mice) (Suez, et al 2014)
- Women's Health Initiative Study: DM risk was associated with SSB and ASB in one large study (Huang et al, 2017)
  - ASB:  $\geq 2$  servings/d vs.  $<3$  servings/month
  - SSB:  $\geq 2$  servings/d vs.  $<1$  serving/week
  - Statistical modeling found 5% risk reduction by substitute 1 serving ASBs with water & 10% for 1 serving SSB for water

# Replacement Beverages: ASB con't

- Inconsistent findings on ASB and diabetes risk & weight loss
  - Greater weight loss and maintenance of weight loss with ASB vs. water approx 2 kg vs 6 kg
- American Heart Association and American Diabetes Association 2011:
  - When used judiciously non-nutritive sweeteners might help with weight loss/control and may have beneficial metabolic effects
  - Still need more research
- Academy of Nutrition & Dietetics Position Paper 2012
  - Non-nutritive sweeteners can aid in weight loss when compared with SSBs

# Recommendations for Intake

- Dietary Guidelines for Americans: Limit added sugars to 10% of daily calories
  - Example: 2000 calorie diet= 200 calories of added sugar (from ALL sources)
- American Heart Association: Daily intake less than 150 calories (men) and 100 calories (women)

200 calories =12 teaspoons= 50 grams of sugar

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200 calories = 12 teaspoons = 50 grams of sugar

**HERE'S WHAT 50 GRAMS OF SUGAR LOOKS LIKE**

The infographic is titled "HERE'S WHAT 50 GRAMS OF SUGAR LOOKS LIKE" and features a grid of images with corresponding text boxes. The items shown are: 16 slices of 100% whole wheat bread, 2 bars of candy, 1 Starbucks Mocha Frappuccino, 3 Yoplait mixed berry yogurts, 1 16-ounce bottle of Coca-Cola, and 25 packets of Heinz ketchup. Each item is accompanied by a text box detailing the quantity and the amount of sugar it contains. The text boxes also include some commentary on the sugar content, such as "Wait — whole wheat bread has sugar?" and "Really satisfies — when it comes to sugar."

**16** 100% whole wheat bread (48 grams of sugar)  
Wait — whole wheat bread has sugar?

**2** bars (54 grams of sugar)  
Really satisfies — when it comes to sugar.

**1** 12-ounce Starbucks Mocha Frappuccino (42 grams of sugar)  
How do they have room left for the coffee?

**3** Yoplait mixed berry yogurts (54 grams of sugar)  
It seems healthy. It's not.

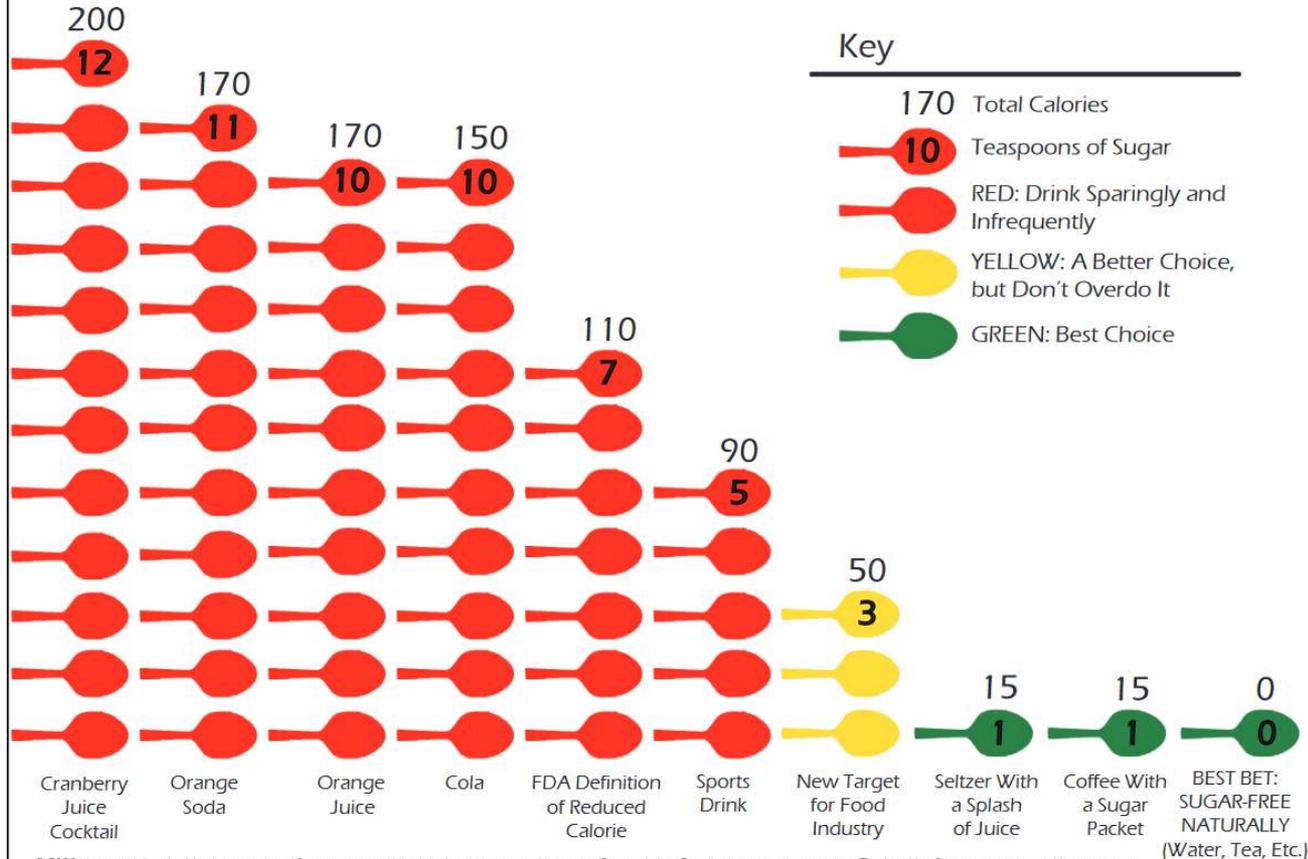
**1** 16-ounce bottle of Coca-Cola (52 grams of sugar)  
That's the equivalent of scarfing 13 sugar cubes!

**25** Heinz ketchup packets (50 grams of sugar)  
There's a surprising amount of sugar lurking in condiments.

# How Sweet Is It?

## Calories and Teaspoons of Sugar in 12 Ounces of Each Beverage

For more information, see The Nutrition Source, [www.hsph.harvard.edu/nutritionsource/healthy-drinks/](http://www.hsph.harvard.edu/nutritionsource/healthy-drinks/)



# Soda Tax

- An example from tobacco- increased price can reduce smoking
  - 10% increase in cigarette price yields 3-5% decline in consumption (varies by race, income, age)
- Places with soda tax implemented:
  - United States
    - Berkeley, Philadelphia, San Francisco, Oakland, Albany CA, Boulder, Cook County (does not apply to soda purchases made with food stamps!!!), Seattle
  - France (2012), Hungary (2011), Ireland (2016, effective 2018)
  - Mexico (2013)
    - 6% decline in annual sales after tax & 4% increase in bottled water sales

# Healthy Beverage Options

## Tea:

- 3 cups of black or green tea may have stroke and cancer preventative properties
- Herbal flavors taste sweet naturally

## What about tea?

- Polyphenols- antioxidants

## Coffee

- 54% of Americans drink on average 3 cups/day; up to 6 can be safe
- May lower type 2 DM risk due to antioxidants and insulin sensitivity

## Hidden Calories

- 8 oz black coffee= 2 calories, be weary of mochas, lattes, blended drinks though!

# Healthy Beverage Options

## Water

- Replenish losses from metabolism, breathing, sweating, waste removal

## How much water?

- Institute of Medicine set adequate daily intake to 100 oz/13 cups for men and 73 oz/9 cups for women

## Flavor it up

- Add sliced citrus fruits, mint, basil, ginger, or cucumber to water



# Conclusion

- Consuming excessive amounts of added sugar, including SSBs is detrimental to health
  - SSB consumption is linked with poor diet quality & excessive energy intake
  - Fructose commonly found in SSBs has a unique contribution to CVD risk due to hepatic metabolism
- Poison is in the dose: limit added sugar to <10% of daily calories
- ASB: short term, may help to swap from SSB to ASB first, then to water for ultimate glycemic control & weight loss
- Water is best
  - IOM Recommends about 13 cups of drinking water for men and 9 for women

Questions?