Is Coffee Good for You

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- June 7, 2025.

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Coffee

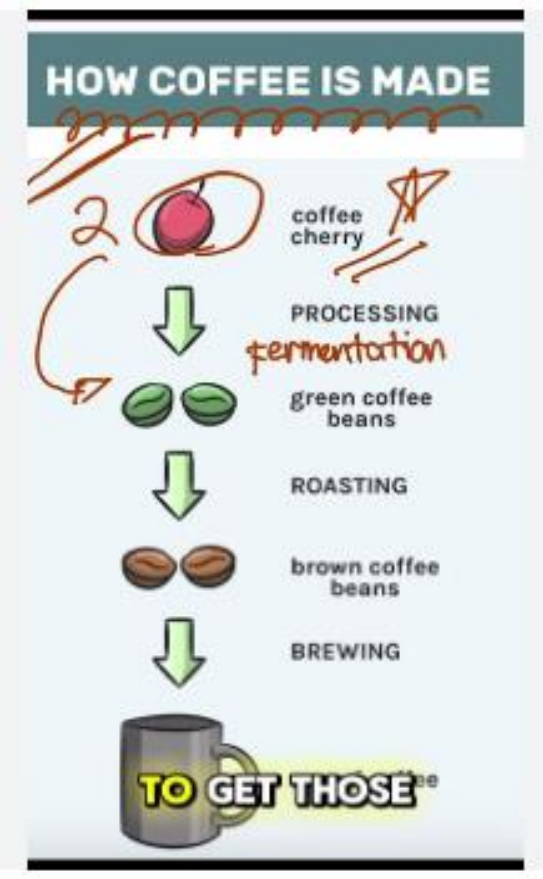
Ethiopian Legend:

9th --- 15th century

- A goat herder named Kaldi noticed his goats becoming unusually energetic after eating the red berries from a certain plant. Curious, he tried the berries himself and experienced a similar effect.

Origin of Coffee

Process of making coffee



- **Washed Process:**
  - remove the outer skin.
  - fermented in tanks

  Natural/Dry Process:
  - The cherries are spread out to dry in the sun
  - This can take several weeks,
- **Roasting:**

  To get their characteristic flavor and aroma.
- **Grinding:**

  ground to the desired consistency
- **Brewing:**

  brewed using a variety of methods, such as drip, French press, espresso,

Caffeine: Improve Brain function

- caffeine 30 to 300 mg is safe for most.
- vigilance
- learning decision-making
- reaction time
- visuospatial reasoning
- concept formation
- memory
- orientation
- attention
- perception

Key Components in Coffee and Health Benefits

Component	functions
Caffeine	A central nervous system stimulant
Chlorogenic Acids (CGAs)	Polyphenols, antioxidant properties.
Trigonelline	Antidiabetic, neuroprotective, anti-inflammatory
Caffeic Acid	Antioxidant, anti-inflammatory, anticarcinogenic
Melanoidins	Antioxidant, anti-inflammatory, microbiota modulation
Cafestol & Kahweol	Anticarcinogenic, anti-inflammatory, hepatoprotective.
Polyphenols	A broad class of antioxidants, including flavonoids and phenolic acids.

Health Benefits of Coffee (and decaffeinated)

- 1. **Cardiovascular Health:** reduced risk of coronary heart disease, heart failure, and stroke.
- 2. **Metabolic Benefits:** Reduced Insulin resistance, risk of type 2 diabetes mellitus and obesity.
- 3. **Neuroprotective Effects:** Parkinson's and Alzheimer's disease. (postmenopausal hormone users, more Parkinson)
- 4. **Liver Health:** Fatty liver, cirrhosis and hepatocellular carcinoma.
- 5. **Cancer Risk:** lower incidence of certain cancers.
- 6. Contain soluble fiber 0.5 g/100 ml
- 7. Improve asthma, but increase lung cancer in smoker
- 8. **All-Cause Mortality**

Benefit of Coffee in some studies

Diseases	RR
CVD	0.84- 0.96
DM-2	0.85-0.96
Metabolic syn	0.86 – 0.95
Gout	0.36 – 0.7
Endometrial cancer	0.89 -0.92
Melanoma	0.8 – 0.99
Liver Cancer	0.8 – 1.08
Chronic liver dis (cirrhosis, NASH)	0.45 -0.84
Alzheimer	0.54 -0.99
Parkinson	0.53- 0.76
Depression	0.87 -0.97

Adv Nutr . 2021 Jul 30;12(4):1160-1176.
BMJ . 2017 Nov 21;359:j5024. 3-4 cups/d

Pros/Cons of Clinical Trials

	Design	Pros	Cons
Retrospective Cohort	link past exposures to outcomes.	Quick/cheap rare outcomes.	recall/selection bias. confounders. No causality
Prospective Cohort	follows participants over time to track exposure → outcome.	Better than retro ↓ recall bias.	Time + cost. Loss to follow-up. Possible causality
Randomized Controlled	randomly assigns people to control vs intervention	Gold standard for causality. No confounding.	Cost, time Unethical, impossible
Meta-Analysis	multiple studies RCTs, retro/prosp cohort	↑statistical power. Resolves conflicting evidence.	Garbage in, garbage out. Heterogeneity

Coffee and Tea in prospective cohort studies.

	# of individual	Coffee/Tea
Meta Analysis	12 study combine 525504	Coffee, green, black tea
Single Japanese	76979	Coffee, green, black, oolong
Single UK	498,158	effects of combination coffee and tea.

Details of above 3 studies in the following slides

Coffee and Tea Mortality Benefit in **Asian** Population, not head to head

	Coffee	Green tea	Black tea
All cause % reduction	Men 24 Female 28	Men 9 Female 6-14	Weak
CVD %	Men 27 Female 27	Men 10-21 Women 12-22	?
Cancer %	Men 13-15 Female 10-25 Other studies +/-	P = 0.234 P= 0.426	?

12 prospective cohort studies from the Asia Cohort Consortium conducted in **China, Japan, Korea and Singapore**, 248 050 men and 280 454 women. follow-up 6.5 to 22.7 years. **Not head to head so unable to compare**

Int J Epidemiol . 2021 Sep 1;51(2):626–640.

Coffee, green tea, black tea and oolong tea consumption and risk of mortality from cardiovascular disease in Japanese 76979 individuals

	CHD	Stroke	
Coffee	0.67	0.45 (men)	
Green tea	0.42 (women)		
Black tea	Not enough #		
Oolong tea	0.39		

Journal of Epidemiology and Community Health. 2011;65(3):230-40.

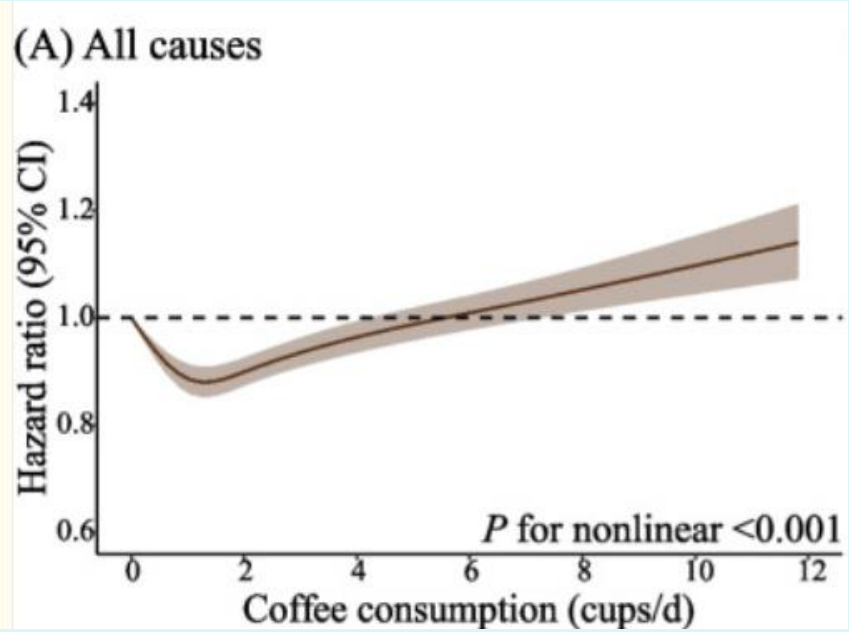
The UK Biobank (single) large-scale prospective study: Compare tea and coffee on mortality

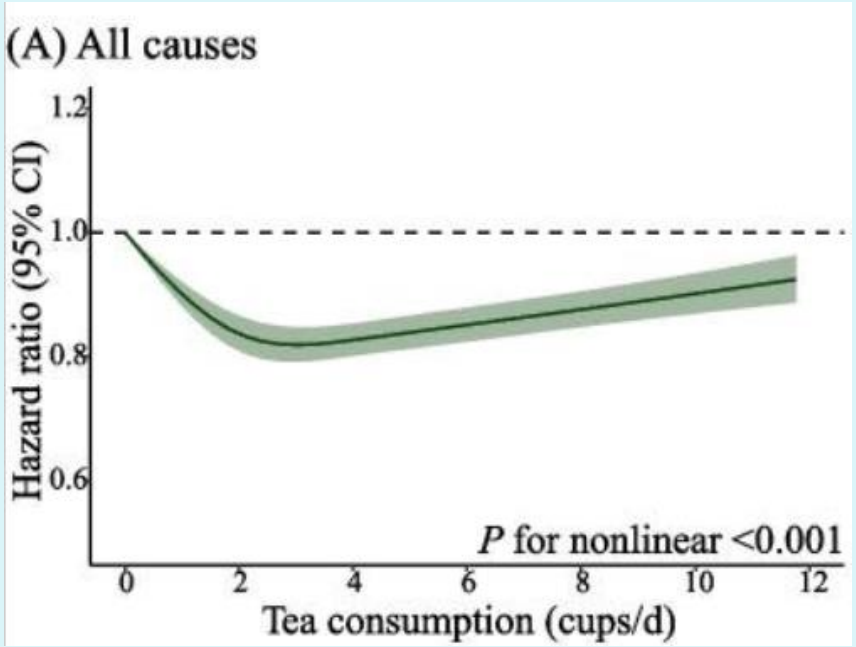
- Prospective, 498,158 participants (37-73 yo) from the UK Biobank enrolled between 2006 and 2010.
- median follow-up of 12.1 years
- including decaffeinated coffee
- (including black and green tea, **majority drank black tea**)

- compared to neither coffee nor tea consumption, the combination of < 1-2 cups/day of coffee and 2-4 cups/day of tea had lower mortality risks for all-cause (HR, 0.78; 95% CI: 0.73-0.85), CVD (HR, 0.76; 95% CI: 0.64-0.91)

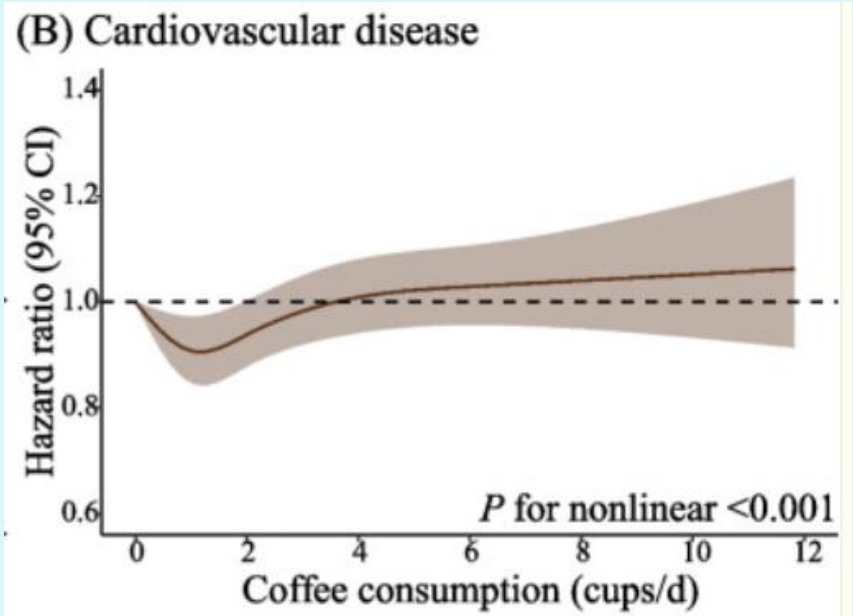
- BMC Medicine. 2022;20(1):449.

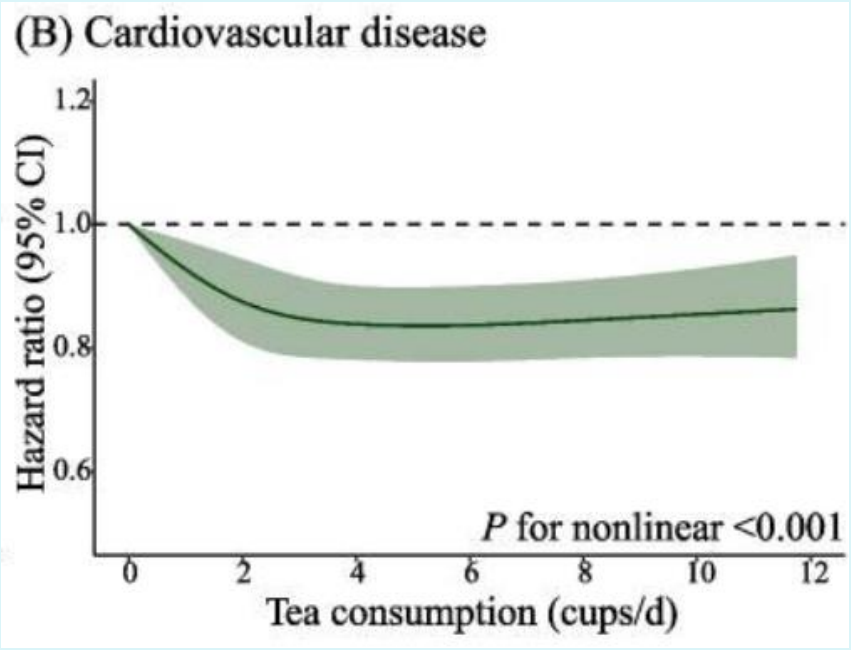
Coffee and tea/all cause mortality UK Biobank





Coffee and tea/CVD mortality
UK Biobank





Tea may be better than coffee? (Mortality comparison)

participants	f/u Y	CVD/ Tea	CVD Coffee	Total /Tea	Total/Coffee
6,508 (1)	11.1	0.53 – 0.95	0.78 - 1.2		
498,158 (2)	10	0.72 -0.91	0.74 -0.93	0.82-0.90	0.83-0.91
37,514 (3)	13	0.37 – 1.11	0.31- 0.97		

(1) am j med 2017 feb;130:188
(2) BMC Medicine. 2022;20(1):449. No significant difference
(3) Arteriosclerosis, Thrombosis, and Vascular Biology. 2010;30(8):1665-71

Is Coffee better than Tea (Mortality) in **Asian** Population, **not head to head**

	Coffee	Green tea	Black tea
All cause % reduction	Men 24 Female 28	Men 9 Female 6-14	Weak
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Int J Epidemiol . 2021 Sep 1;51(2):626–640.

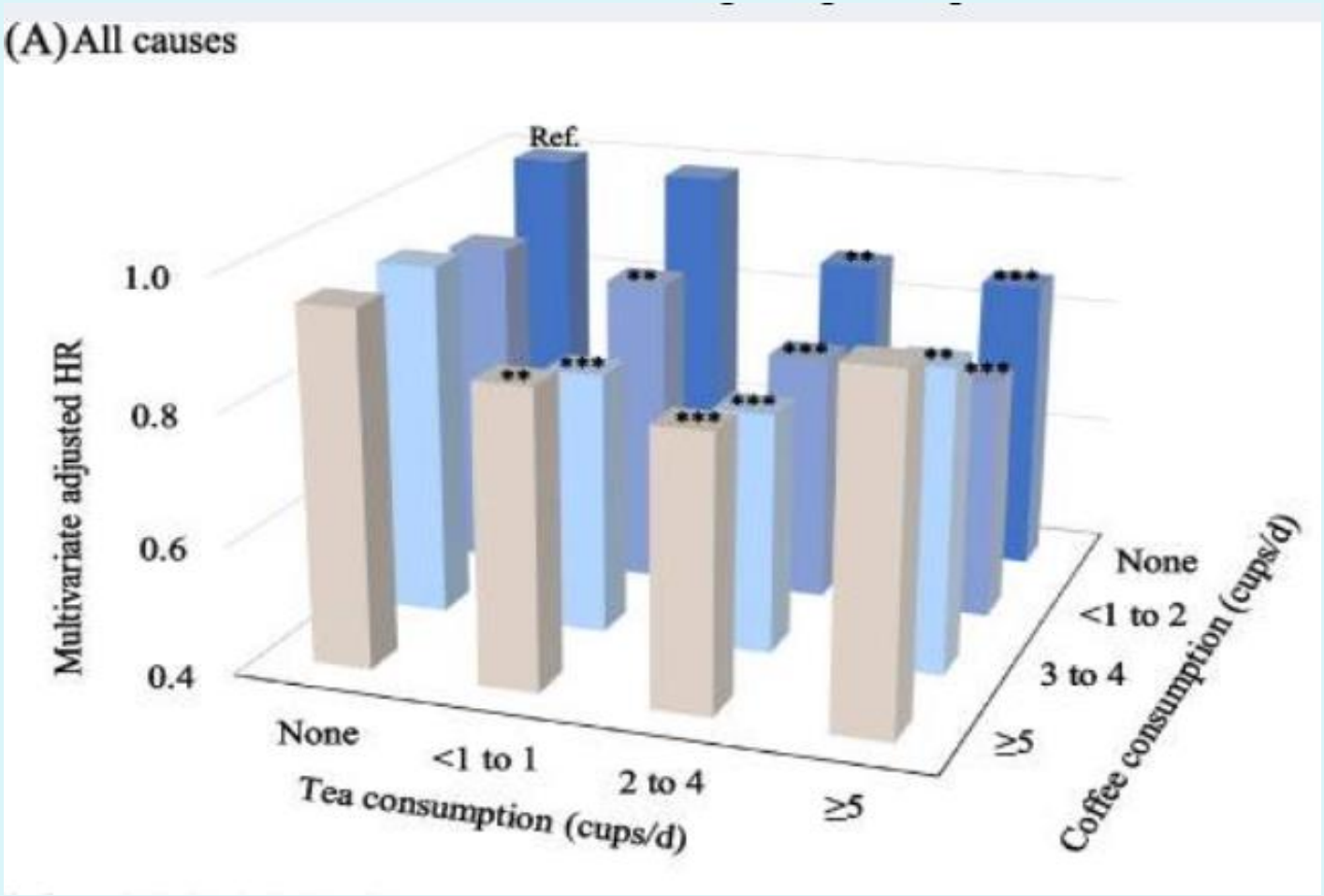
Combination of Tea and Coffee is better

- 1-2 cups/ coffee + 2-4 cups tea/d had lower mortality risks
  - All-cause HR 0.73-0.85
  - CVD HR 0.64-0.91.
  - Respiratory HR 0.57-0.83
  - GI HR 0.34-0.53

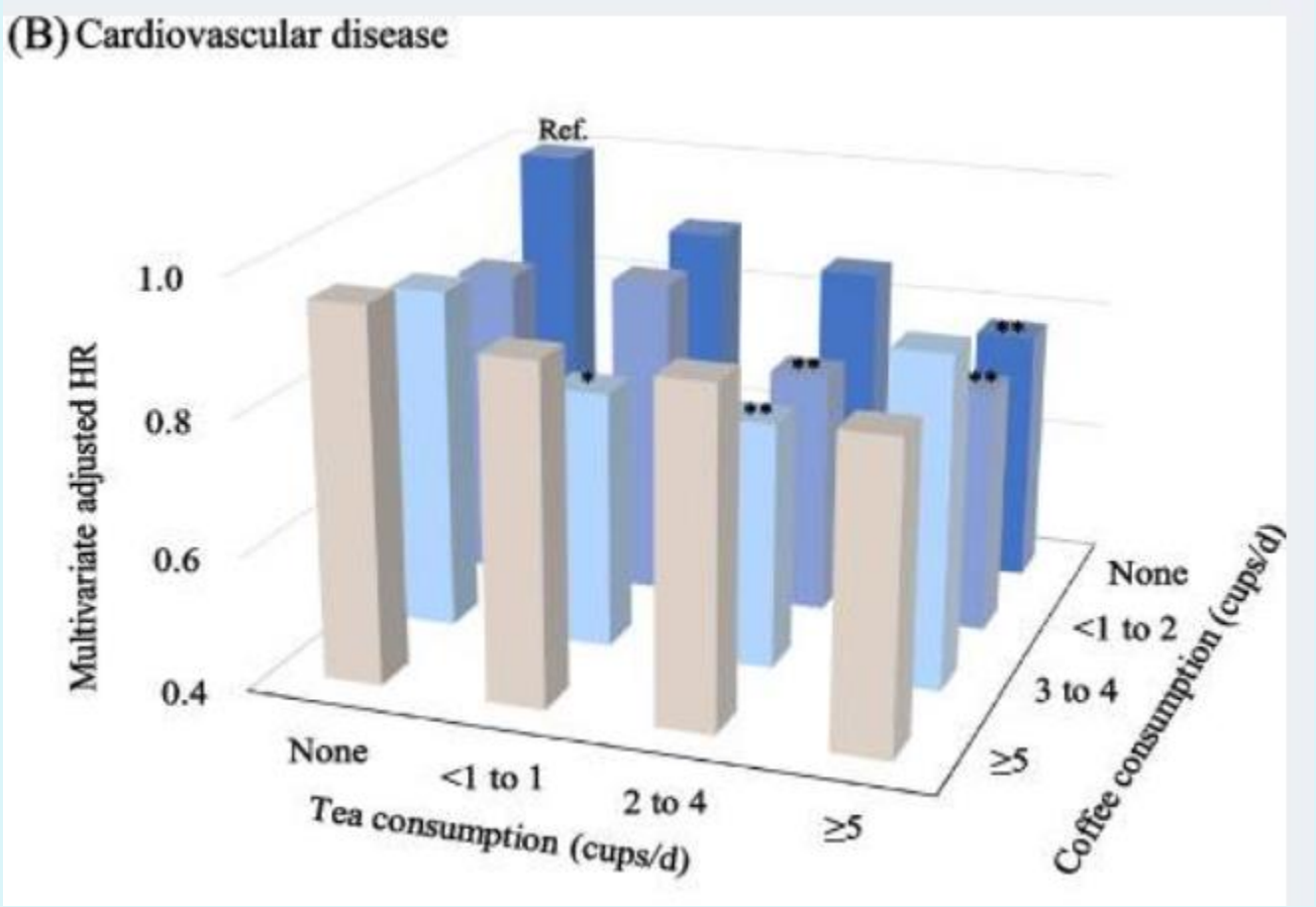
- UK Biobank study: BMC Medicine. 2022;20(1):449

- Other large cohort studies do not demonstrate clear superiority of one beverage over the other in direct comparison

Tea and Coffee/ All cause mortality UK Biobank



Tea and Coffee CVD, UK Biobank

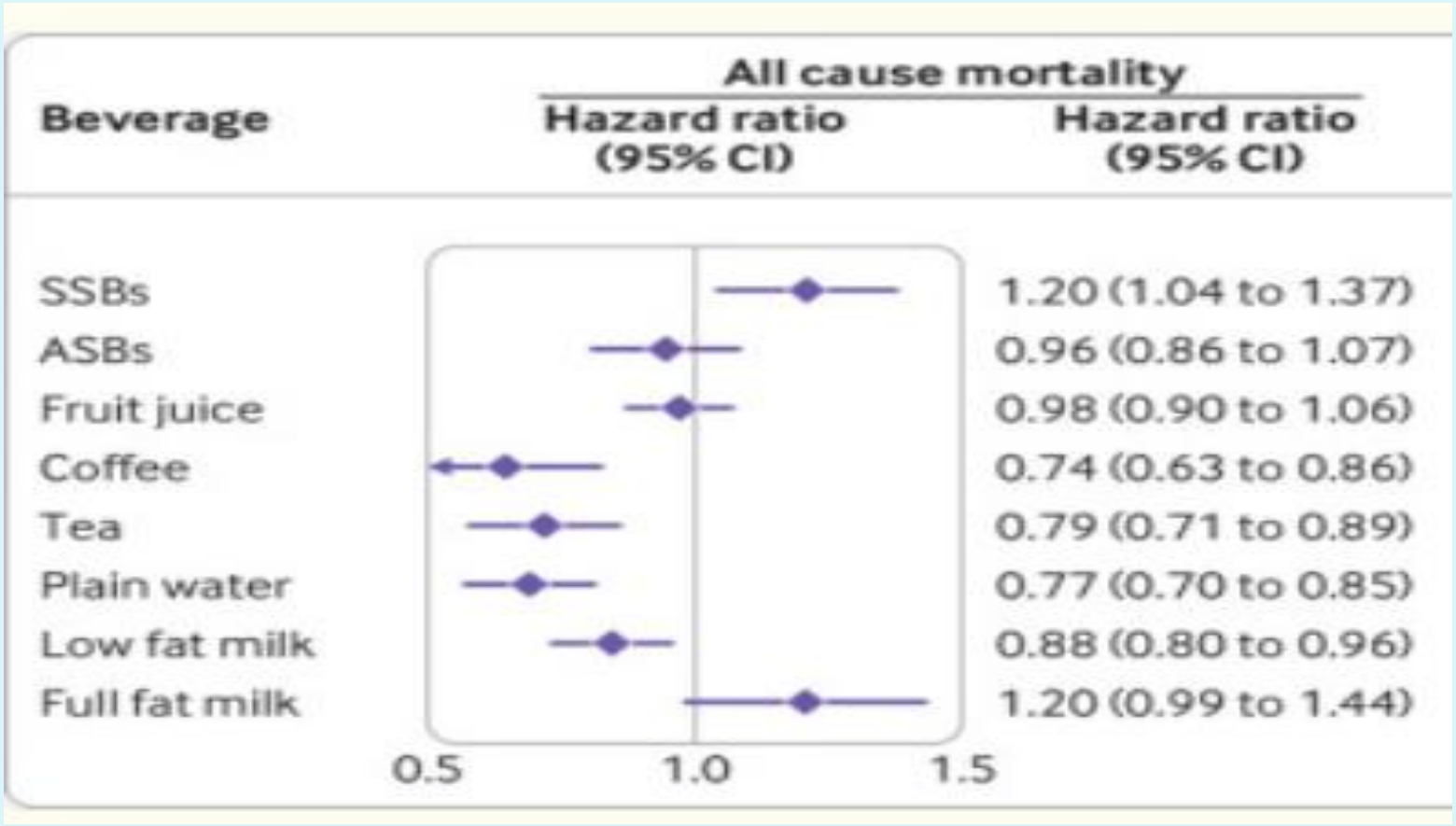


Is water better than tea or coffee

- BMJ 2023 Apr 19;381:e073406
- 15 486 men and women with a diagnosis of type 2 diabetes at baseline
- 18.5 years of follow-up, updated q2-4 years.
- US Nurses' Health Study, Health Professionals Follow-Up Study age 61.3, 73.6% female, White 95%, 49.3% death

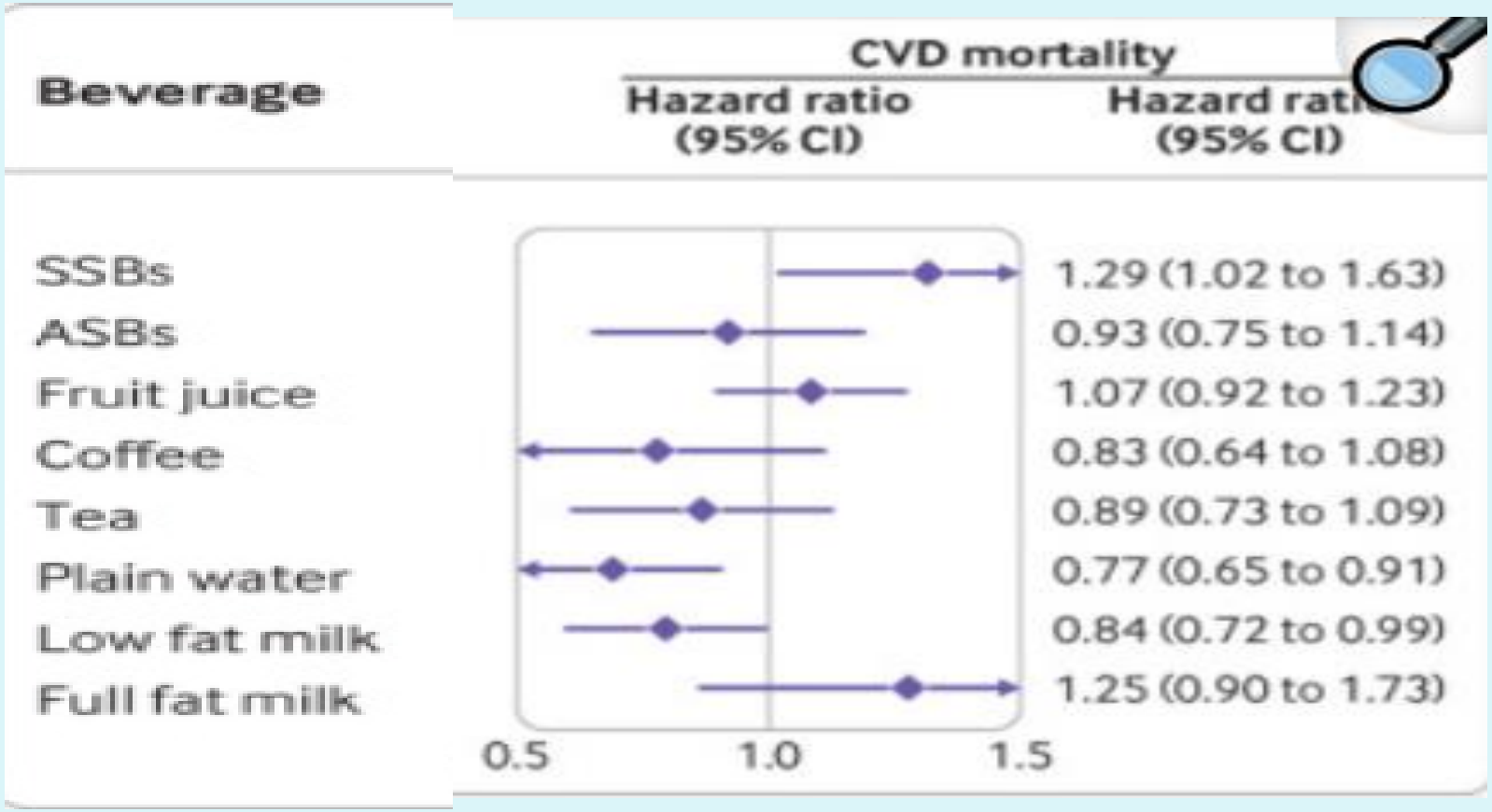
- Correlation coefficients for water was 0.5, other beverage were around 0.8

All cause mortality, types of beverages in type 2 diabetes.

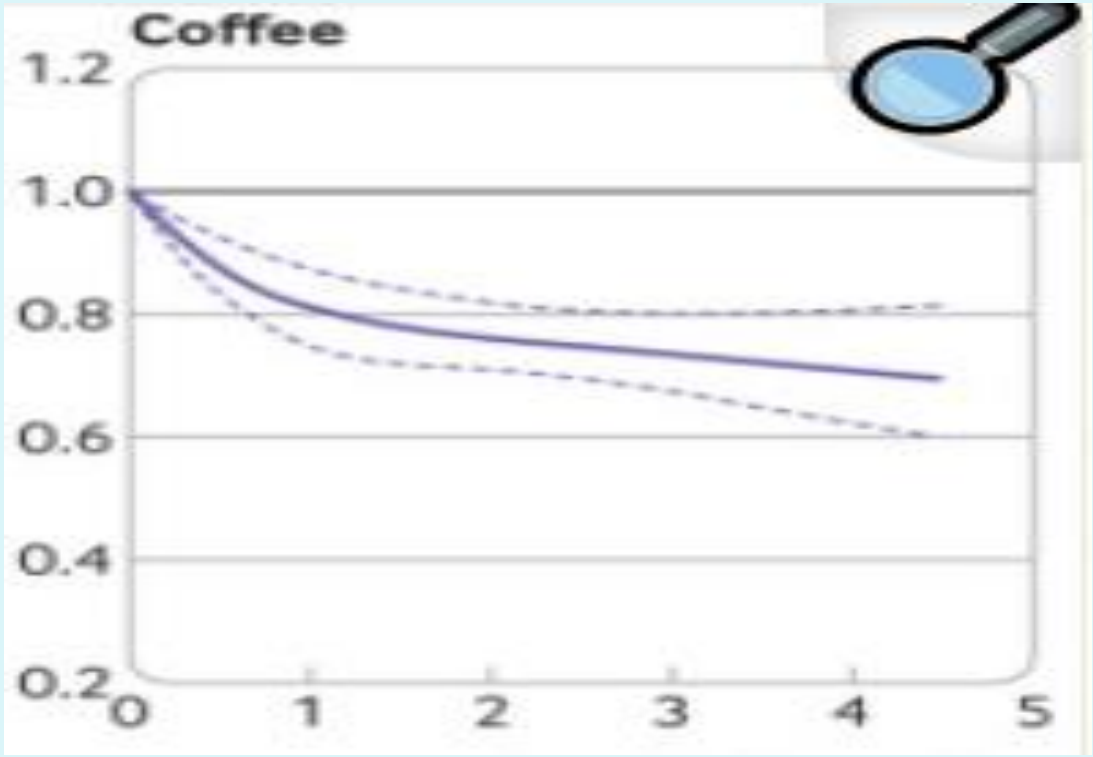


ASB=artificially sweetened beverage; SSB=sugar-sweetened beverage

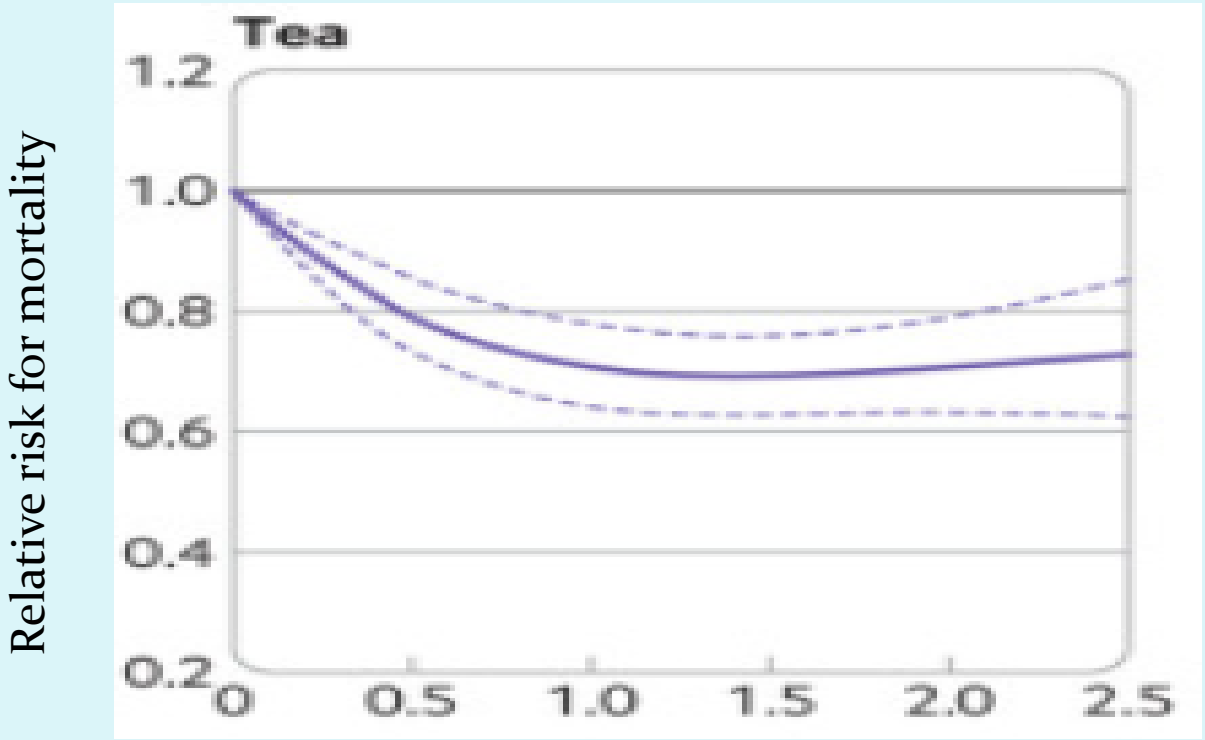
CVD mortality, types of beverages among type 2 diabetes.



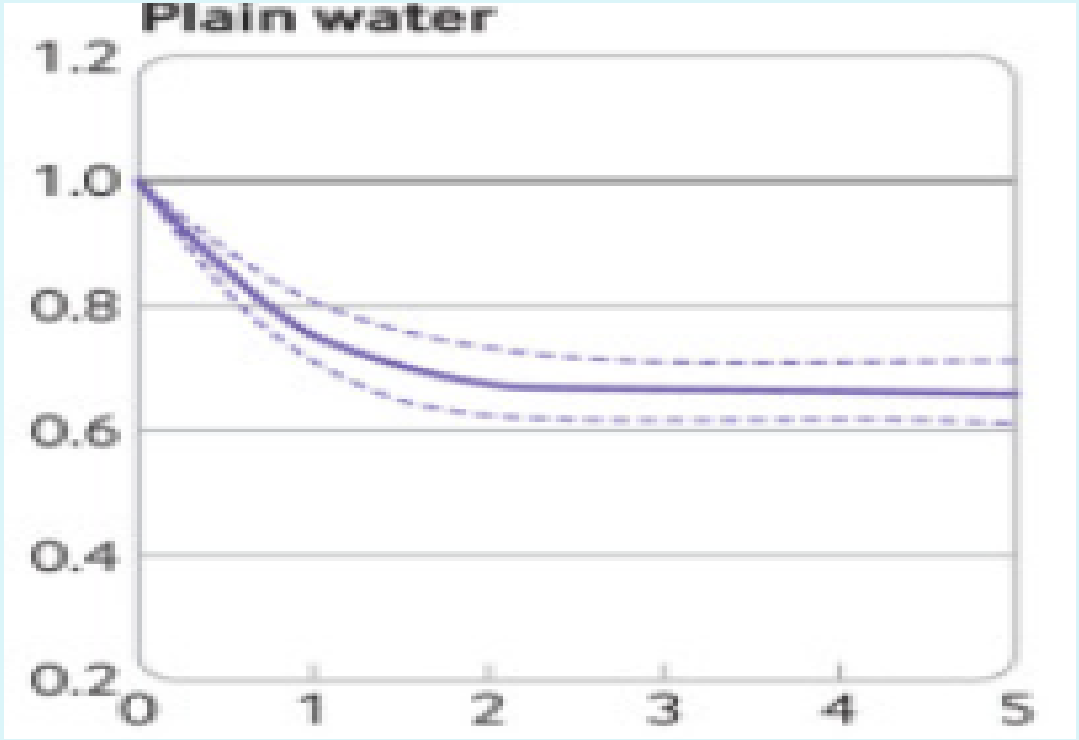
of Coffee drink and all cause mortality among type 2 diabetes.



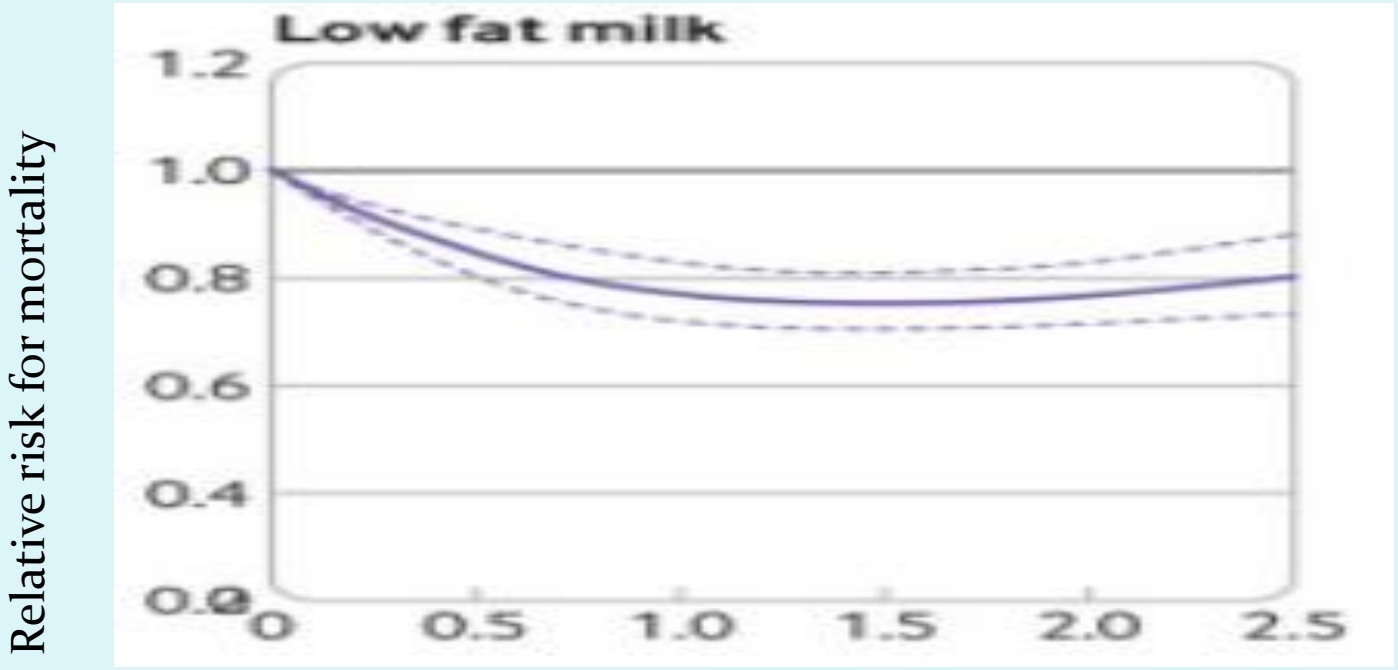
of Tea drink and all cause mortality in type 2 diabetes.



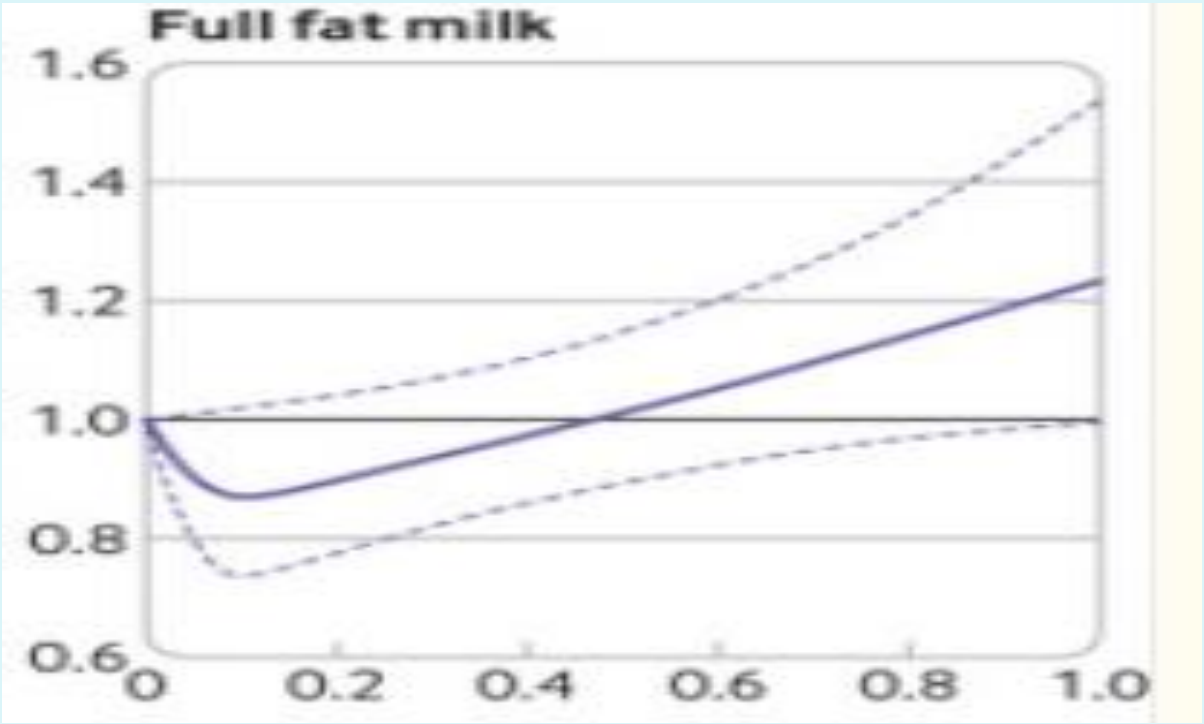
Water and all cause mortality in type 2 diabetes.



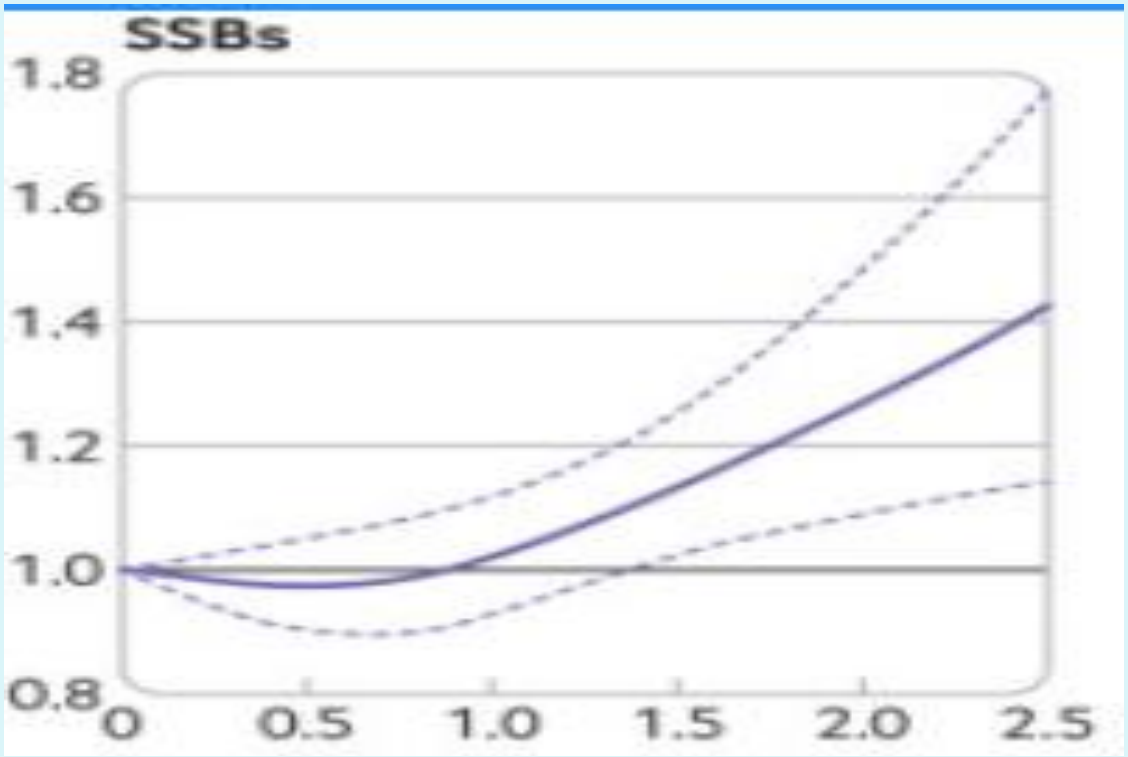
Low Fat Mild and all cause mortality in type 2 diabetes.



Full fat mild and all cause mortality in type 2 diabetes.



Sugar sweetened beverage and all cause mortality in type 2 diabetes.



Is water as good as Coffee?

- **Based on the available literature, coffee appears to provide a more robust and consistent mortality benefit than water**
- Meta-analyses and large US cohort studies show no significant association between higher water intake and all-cause mortality, though there may be a modest benefit for cardiovascular mortality
- Correlation coefficients for water was 0.5, other beverage were around 0.8 in the above study in DM population.

- The American Journal of Clinical Nutrition. 2017;105(1):212-220
- International Journal of Clinical Practice. 2021;75(12):e14878

Coffee classifications

- Origin: Arabica vs Robusta
- Processing: Instant, Decaffeinated, regular
- Filter used: no filter, metal, and paper
- Brewing method: Grinding size, time, pressure and additions (Sugar, water, milk, cinnamon)

Arabica vs Robusta Coffee/Origin

	Arabica coffee	Robusta
Origin	Ethiopia, East Africa	Central and West Africa
Altitude/climate	High/ cooler	Low/ hotter
Growth	Brazil, Colombia, Costa Rica, Ethiopia, Arabian Peninsula	Vietnam, Brazil, Indonesia, Uganda, and India
Growth in China	95%Yunnan, Fujian, Guangxi	5% Hainan, Guangdong Guangxi
Consumption	65%, Finland, Norway, Sweden, global	35%, Italy, France, Vietnam global
Mortality benefit	Yes, not sure which is better.	Yes, less studies
Total Antioxidants	Lower	Higher
Caffeine	1 x	2 x
Cafestol/Kahweol	Less	More, LDL elevation
Acrylamide	Less	More
Roasting	Lighter	Darker

Instant, Decaffeinated, and Regular Coffee

	Instant	decafeinated	Regular
Production Method	freeze-drying to create soluble powder	methylene chloride, ethyl acetate), to remove caffeine	ground coffee beans brewed with hot water
Contaminations	minimal acrylamide	trace methylene chloride	Cafestol/Kahweol if not filtered
Mortality Benefit	reduce mortality	Similar to regular	Stronger evidence reduced risks
Note	Convenience	Do not want caffeine	Want all

Acrylamide and methylene chloride : neurotoxicity, carcinogenicity, reproductive , hepatotoxicity

- Caffeine is an antagonist of central and peripheral nervous system adenosine receptors

- Half-life of Caffeine 4-5 hr
- Pregnant women (T1/2 is 15 hr)

Side Effects of Coffee and Who should minimize coffee intake

- 1. **Caffeine-Related Issues: insomnia, anxiety,** tremulousness, and palpitations.
- **A-fib**
- **Sz** > 480 mg/d
- 2. **Bone Health: Osteoparosis,** inhibits osteoblast activity and promotes osteoclastogenesis,
- 3. **Pregnancy:** low birth weight, and pregnancy loss.
- 4. **Lipid Profile:** Unfiltered ↑ cholesterol levels due to cafestol and kahweol
- 5. GI: GERD, abd discomfort, loose stools
- 6. Withdraw

Drinking habit

	Light	Heavy
Daily Consumption	1–2 cups	> 3 cups
Frequency	Morning or occasional	Throughout the day
Preferred Coffee Type	Mild roasts, decaf, specialty drinks	Dark roasts, black coffee, espresso
Dependence	No	Yes

8 oz = 100 mg caffeine
Adults < **400 mg caffeine/day**
Pregnant : < **200 mg caffeine/day**

Caffeine in Coffee and Tea

	Serving size, oz (mL)	Caffeine, mg
Coffee, brewed	8 (240)	102 -200
Coffee, instant	8 (240)	27-173
Black tea, brewed	1 tea bag	40-70
Green tea, brewed	1 tea bag	20 - 45
Da Hong Pao	1 tea bag	30-50
Tie Guan Yin	1 tea bag	20-60
Pu-erh	8 (240)	30-70
Herbal teas	1 tea bag	0
Excedrine Migraine	caplets	130

How to Choose Coffee

Less Heavy Metal/chemical

- **Costa Rica**
  strict environmental regulations
- **Kenya**
  high-altitude regions.
- **Hawaii (USA)**
  strict U.S. regulations
- **Peru**
  organic, avoiding synthetic pesticides and fertilizers
- **Ethiopia**
  high-altitude regions with minimal human interference.
- **Colombia**
  many farms certified as organic or Rainforest Alliance-approved.
- **Brazil (Organic Farms)**

More Heavy Metal/Chemical

- **Vietnam** :
  - **pesticide** and **arsenic (As)**
- **Indonesia** :
  - **arsenic (As)** and **cadmium (Cd)**
- **China** :
  - certain regions **lead (Pb)** and **cadmium (Cd)** industrial pollution
- **India** :
  - **Pesticide, chromium (Cr)**
- **Ethiopia** :
  - **cadmium (Cd)** and **lead (Pb)**
- **Colombia** :
  - some regions near urban or industrial areas **lead (Pb)** and **pesticide residues** .
- **Brazil** :
  - some regions levels of **cadmium (Cd)** and **lead (Pb)** volcanic soils

Choosing Safer Coffee:

- **Look for Organic Certification**
- **Choose Single-Origin Beans not blended** : These are often grown in remote areas with less industrial contamination.
- **Check Roast Levels** : Light or medium
- **High altitude**, colder, longer time to mature, less industrial contamination

High altitude: better taste, less contamination, same benefit

- **Higher altitudes** , higher levels of phenolic compounds/antioxidants
- **Chlorogenic Acid**: Higher altitudes higher levels of this antioxidant
- **Antioxidant Capacity** is not correlated with mortality benefit by clinical trials

How to make Coffee

How to make a good coffee

- **Reliable sources:** Arabica, high altitude, single-origin, organic
- **Freshly roasted** beans, Light to medium roasted
- **Grind fresh**
- **Water** , 195-205 F, Too hot = bitter; too cool = under-extracted-sour
- **Paper-filtered** to remove cafestol and kahweol
  - drip, pour-over
- **Natural added:** May add cinnamon or plant milk,
- **No sugar, cream or high-fat milk**
- Drink it at appropriate time (half life 5 hr)

Brewing Methods	Cafestol kahweol	**Filtered or not**
Espresso	Medium-High	Metal filter, shorter time, high pressure.
French Press	High	Metal filter do not remove C.K.
Turkish Coffee	Very High	Boiled, Finely ground coffee not filtered;
Scandinavian/Koch)	Very High	Boiled, unfiltered.
Pour-Over	Low	Paper filters remove CK.
Drip Coffee	Low	Most machines use paper filters.
Cold Brew	Low-Medium	Room temp, or lower, 12-24h, metal or paper filtered
Moka Pot	Medium-High	Similar to espresso but more water.

Risk and benefit of Cafestol/Kahweol in non-paper filtered coffee.

- **Potential Benefits of Cafestol/Kahweol**
  - Antioxidant activity
  - Anti-inflammatory properties
  - Potential liver protection (some studies link them to lower risk of liver disease)
  - Neuroprotective effects (preclinical studies)
- **Potential risk of Cafestol/Kahweol**

  Elevate LDL

Prospective study on filtered vs unfiltered coffee on mortality

Hazard ratios	No coffee	Filtered Male	Filter f Female	Unfiltered Male	Unfiltered Female
Any cause	1	0.82-0.9	0.81- 0.9	0.91-1.01	0.86-0.96
CVD	1	0.81- 0.96	0.71- 0.89	0.89 -1.07	0.74- 0.93

508,747 men and women aged 20-79 participating in Norwegian cardiovascular surveys were followed for an average of 20 years with respect to cause-specific death.

Unfiltered brew was associated with higher mortality than filtered brew, and filtered brew was associated with lower mortality than no coffee consumption.

Eur J Prev Cardiol . 2020 Dec;27(18):1986-1993.

Paper to filter Cafestol/Kahweol

Drip Coffee

Automatic

Pour-over

Manual control

- How to make Coffee

Small coffee maker with bean grinder

Metal Filter Coffee Makers
Do NOT remove cafestol/kahweol effectively.
Buy a good grinder + Coffee maker with paper filter

Adjustable grinder and drip coffee maker with paper filter

Adjustable Coffee Grinder
Burr Grinder for best results

- Match it to your brew method:
- Drip/Pour-over: Medium grind → Baratza Encore
- French Press: Coarse grind → Any mid-range burr grinder
- Espresso: Fine grind → Espresso-specific burr grinder

Fancy Coffee machines:
cafestol and kahweol not removed

Coffee type	Preparation	Strength
Espresso	Finely ground brewed under high pressure.	Strong, concentrated
Long Espresso	Similar to espresso but with more water double the volume.	Slightly less intense than regular espresso. ET 60”
Americano	Espresso diluted with equal or greater amount of hot water	Extraction time (ET) 25” Less strong
Espresso Macchiato	Espresso topped with a small spoonful of foamed milk/bubble.	Strong espresso with small bubbly milk, no water
Latte Macchiato	More Milk is steamed first, then espresso is "marked" on top	More milk, No water
Cappuccino	Equal parts espresso, steamed milk, and frothed milk	No water, same amount of Caffeine as LM

Instant, Decaffeinated, and Regular Coffee

	Instant	decafeinated	Regular
Production Method	freeze-drying to create soluble powder	methylene chloride, ethyl acetate), to remove caffeine	ground coffee beans brewed with hot water
Contaminations	minimal acrylamide	trace methylene chloride	Cafestol/Kahweol if not filtered
Mortality Benefit	reduce mortality	Similar to regular	Stronger evidence reduced risks
Note	Convenience	Do not want caffeine	Want all
Cafestol/Kahweol	Mostly Removed	Not removed, Unless processed w CO_2 method	Removed if paper filter used

Acrylamide and methylene chloride : neurotoxicity, carcinogenicity, reproductive , hepatotoxicity

Filtered, unsweetened, light roast provide the best mortality benefit

Type		Characteristics
Ground	0.73	Brew coffee right after grinding coffee bean
Unsweetened		Sugar Damper the mortality benefit
Filtered Coffee		paper filters to removes cafestol and kahweol (raise cholesterol).
Unfiltered Coffee		Includes French press, Turkish, or boiled coffee;
Decaffeinated	0.86	similar antioxidant content to regular coffee.
Espresso		brewed under pressure; higher caffeine per ounce.
Instant Coffee	0.89	Processed coffee powder; lower chlorogenic acid content compared to brewed coffee.
Light Roast Coffee		Higher chlorogenic acid content; milder flavor.
Dark Roast Coffee		Lower chlorogenic acid content; stronger flavor and aroma.

Coffee drinks: Origins and Prices

	Sources	Single Origin	Processing	Price
Family Shop	Ethiopia, Colombia	Yes	Small-batch roasting, often artisanal methods	$10–$25+
Starbucks	Ethiopia, Colombia, Brazil, Guatemala	Yes, but Limited	industrially roasted, medium-dark to dark roast; blended	$12–$18
Costco	Colombia, Brazil, Central America	Rarely	industrial roasting; medium roast, pre-ground or whole bean, blended	$7–$12
Walmart	Brazil, Colombia, Vietnam	Rarely	Industrial roasting; Folgers, Maxwell House; pre-ground or whole bean, blended	$5–$10
McDonald's	Brazil, Colombia, Centr America	No	industrially processed; Medium roast; blended	$1–$3

Summary

- No randomized, long term trials available.
- Most prospective clinical trials: Beneficial. Coffee = Tea
- 1-2 cups/ coffee + 2-4 cups tea/d had lower mortality risks for all-cause (HR, 0.78; 95% CI: 0.73-0.85), CVD (HR, 0.76; 95% CI: 0.64-0.91).
- Chose reliable sources to reduce heavy metal or chemical contamination, high altitude.
- Adding sugar offset the health benefit of tea and coffee
- Paper Filtered Coffee: remove cafestol/kahweol
- Am Coffee, Pm tea (?before 2 pm, 铁观音 大红袍)
- If you need and like caffeine, chose coffee, o/w tea
- Correction of other mortality risk factors could be more important, such as HTN, smoking, obesity……