



Caffeine

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Caffeine, Coffee and Tea

- People have been drinking coffee and tea for thousands of years
- Today coffee is so widely consumed, it is the ***second-most traded product in the world after petroleum***
- Americans lead the world in coffee consumption
- We drink more than ***500 million cups*** a day-nearly 2 cups per person

Origins of Coffee

- According to legend, an Ethiopian goat herder discovered coffee
- He noticed that his goats became very lively after eating berries from a certain tree and were too excited to sleep at night
- Kaldi reported the strange behavior to the local abbot, who prepared a concoction of the mysterious berries for himself
- The abbot noticed that he was more alert during his evening prayer so he told the other monks about it and soon word of the berries' stimulating effects spread

Origins of Coffee

- Arabs were the first to cultivate and trade coffee in about 1,000 AD
- The word "coffee" comes from an Arabic word meaning "excitement."
- By the mid-17th century, London and Paris boasted more than 300 coffee houses and coffee had also become popular in the New World
- Prior to the American Revolution, colonists were outraged when King George of England imposed a heavy tax on tea
- Their frustration culminated in the revolt know as the Boston Tea Party – an event that may have helped shape our national preference for coffee

Coffee

- Today 50% of the world's coffee is grown in Brazil
- 25% from other Latin American countries
- Nearly 20% from Africa



History of Coffee

Date	Event
~850	- Coffee beans discovered - The fable says that an Ethiopian goat or shepherd noticed that the goats were more alert after eating the wild berries. He then sampled this new delicacy.
~1100	- First coffee trees and roasting of coffee beans.
1475	- Constantinople – the world's first coffee house.
1600s	- Coffee enters Europe and moves quickly to the Americas
1700s	- Coffee house open throughout Europe.
1723	- First coffee plants are introduced into the Americas.
1822	- First espresso machine is created in France.
1938	- First instant coffee invented by the Nestlé company.
1971	- Starbucks opens its first location in Seattle, Washington's Pike Place Market – and the rest is history!

History of Tea

Date	Event
3000 B.C.	- Tea discovered in China or introduced from India
350 B.C.	- First written description of Tea drinking in China.
450 A.D.	- Turkish traders bargain for Tea and the Silk road is born.
800	- Tea introduced to Japan.
1450	- Japanese Tea ceremony created and popularized
1610	- Dutch bring Tea to Europe
1773	- Boston Tea party, rebellion against England's tea tax
1776	- England sends first Opium to China to help pay for tea.
1835	- First experimental tea plantations in Assam, India.
1908	- Tea bags invented in New York.

History of Chocolate

Date	Event
400 B.C.	- Olmec people of Mexico made chocolate drinks
250 A.D.	- Mayans of Mexico were cultivating cocoa crops
1528	- Cocoa was brought to Spain by Hernando Cortés
1600s	- Chocolate drinks introduced into Europe
1657	- First English chocolate houses open
1828	- Screw press that extracted the cocoa butter from the beans invented in Holland
1840s	- Chocolate as solid developed and history was made!

Caffeine and Society



- Caffeine is the most widely consumed psychoactive drug in the world
- Nowadays, with over 400 billion cups consumed every year, coffee is one of the world's most popular drinks.
- Chemically known as 1,3,7-trimethylxanthine and occurs naturally in about 60 plant species, of which cocoa beans, tea and coffee are the best known

Caffeine

- Coffee is a complex beverage containing >1,000 compounds.
- Among the many with known biological activity are caffeine (a potent stimulant and bronchodilator)



Caffeine



- 90% of people in the world use caffeine in one form or another.
- In the U.S., 80% of adults consume caffeine every day
- Caffeine is a *central nervous system stimulant*.
- Your central nervous system includes your brain, spinal cord, and the other nerves in your body.

Caffeine

- Caffeine is rapidly absorbed upon ingestion and is 100% bioavailable
- Peak absorption occurs within minutes of ingestion and remains stable for about 1 hour
- Caffeine mildly stimulates the nervous system, improving alertness, mood and stamina

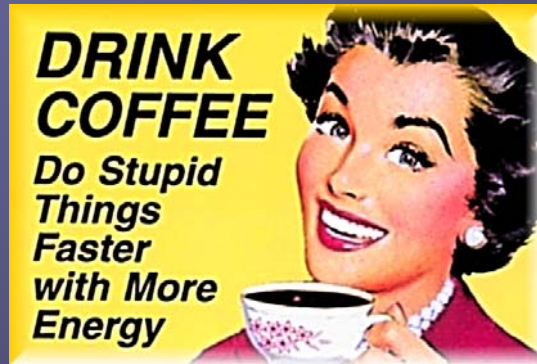
Caffeine

- Constricts blood vessels in the brain and decreases cerebral blood flow – may explain why it eases headache pain for some people
- Relaxes bronchial smooth muscle, to aid in easier breathing, helpful for some people with respiratory problems (asthma)
- Increases blood flow to the muscles
- Releases fatty acids from adipose tissue

Caffeine



- Caffeine can also:
- Make you jittery and shaky
- Make it hard to fall asleep, stay asleep, or get a good night's sleep
- Make your heart beat faster
- Cause an uneven heart rhythm or arrhythmias (but does NOT cause atrial fibrillation or flutter)
- For some people, it can raise blood pressure
- Cause headaches, nervousness, and/or dizziness
- Make you dependent on it so you need to take more of it
- Caffeine increases the release of acid in your stomach, sometimes leading to an upset stomach or "heartburn."



Caffeine

- The average cup of coffee contains 100-150 mg of caffeine
- Most Americans consume 400-750 mg of caffeine a day
- Coffee is the primary source of caffeine in the average adult's diet
- 10 grams of caffeine is considered fatal!



Caffeine

- Caffeine is considered an anti-nutrient since it hampers the absorption of essential minerals including iron, calcium, magnesium, zinc and potassium as well as the B vitamins
- For example drinking a cup of coffee while eating a hamburger can reduce the amount of iron you absorb in the meat by 40%
- Peak blood (plasma) levels usually with 30-60 minutes

Caffeine

- The half life (time it takes for the body to expel half of the caffeine consumed) may range from 3-15 hours
- Different conditions affect its rate of metabolism
- For women the half-life of caffeine is 25% longer during the luteal phase (the 14 or so days preceding the onset of menses) than during the follicular phase (which begins at menses)
- The use of oral contraceptives on the other hand may **double the half-life of caffeine!**
- Smoking speeds the metabolism of caffeine and in adult male smokers the half -life is reduced by 30-50%

Half-life

How long it takes to leave the body

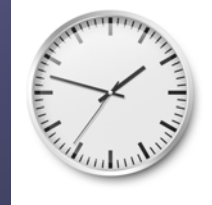
Average adult – 3-5 hrs

Child less than 6 months – 24 hrs

Pregnant – 7-8 hrs

Smoker – 2-3 hrs

Some people are poor detoxifiers of caffeine and it will remain in the system for much longer – up to 15 hrs!



Metabolism/Elimination

- Metabolized in the liver
- Changed to di- and mono-methylxanthines
- Excreted in the urine



Mechanism Of Action

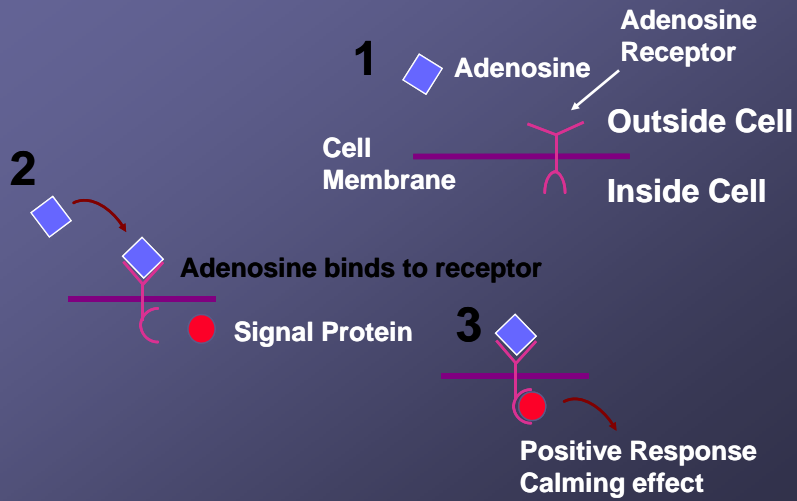
Blocks Adenosine receptor

Adenosine is a calming neurotransmitter

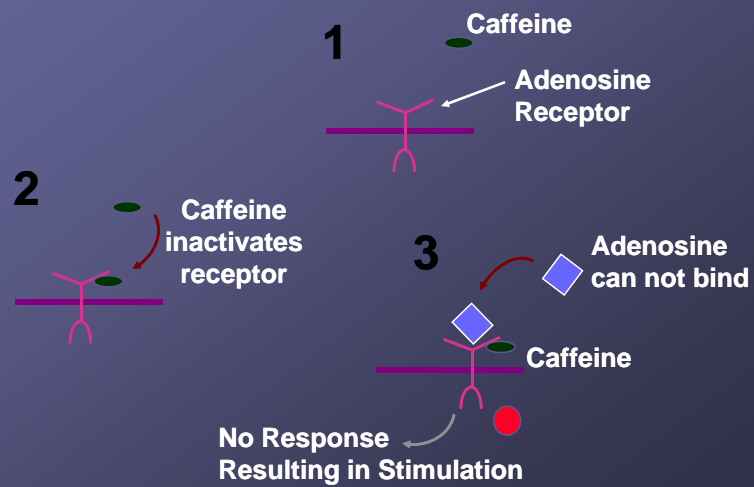
Caffeine and Adenosine

- On a cellular level, caffeine competes with adenosine, a brain chemical that normally induces a sense of *calm*
- Caffeine blocks adenosine receptors
- High energy or jitteriness associated with caffeine is attributed to adenosine receptor antagonism

Normal Action of Adenosine



Action of Caffeine



Coffee

- Coffee comes from a genus of plants known as *coffea*, a member of the *Rubiaceae* family (includes more than 6,000 species of tropical trees and shrubs)
- Just 2 of these produce the coffee we consume: *coffea arabica* and *coffea caneflora* (known as *robusta*)
- *Arabica* is responsible for 70% of the world's coffee production and is preferred by most Americans
- *Robusta*, used for milder roasts, is grown mainly in Africa

Coffee

- It takes nearly a year for a coffee cherry to mature after the flowering of the fragrant, white blossoms
- It takes 5 years for a coffee tree to reach maturity
- Average annual yield from one of these trees is the equivalent of one roasted pound of coffee (\$\$\$)
- Coffee trees may live as long as 20-30 years
- Roasting process determines the color/flavor as well as intensity/acidity of the beans
- Darker roasts are processed longer and at a higher temp
- Lighter roasts, which have a more delicate flavor, are actually higher in caffeine

Antioxidants

- Coffee is the number one source of antioxidants in the U.S., according to researchers at the University of Scranton.
- Joe Vinson, Ph.D., lead author of the study, said that "Americans get more of their antioxidants from coffee than any other dietary source. Nothing else comes close."
- Caffeinated and decaffeinated versions provided nearly the same levels of antioxidants

Decaf Coffee

- Many coffee drinkers believe that they can avoid negative effects of caffeine by switching to decaf
- The oils, acids, tannins and other chemicals in regular coffee are also in decaf
- Also, the processes used in both roasting and decaffeination can add other potentially harmful substance to the mix
- Buy organic – less pesticide residue

Decaf Coffee



- There are 2 different processes for decaffeination
- The *solvent process* uses methylene chloride and ethyl acetate to extract caffeine
- The solvent process is thought to play a role in causing cancer in humans so it is used less often
- In the *water process*, beans are soaked in water and a solvent is added to the liquid to extract the caffeine
- The solvent is removed from the fluid and the fluid is restored to the beans

Decaf Coffee

- In the water process, the solvent does not come into direct contact with the beans and the beans are slightly more decaffeinated
- Swiss water processed decaffeination is considered the safest way to decaffeinate coffee



Organic Coffee

- Coffee is a heavily sprayed crop, so drinking organic coffee might reduce or eliminate the exposure to toxic herbicides, pesticides, and fertilizers.
- The only drawback is that the countries where coffee is produced probably have *less control and monitoring for compliance to organic practices*.
- You will also be helping to protect the health of the people working in the coffee fields, as you will be helping to reduce their toxic exposure as well.



Dopamine

- Caffeine may also enhance dopamine activity – the “feel good” chemical in the brain
- Dopamine is a neurotransmitter associated with pleasure, high-spiritedness and increased physical activity



Stress Hormones

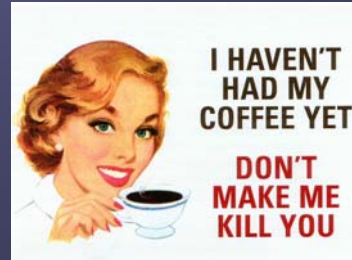
- Caffeine also raises levels of hormones such as epinephrine (adrenaline) and norepinephrine
- These “stress hormones” are secreted by the adrenal glands as a response to threatening situations or stimuli
- Cause short-term increases in blood pressure, heart rate, muscle strength, sugar metabolism (affecting blood glucose levels) while relaxing bronchial smooth muscle (to aid in easier breathing)

Suppress Appetite

- Caffeine can suppress appetite so it is often added to weight-loss drugs/supplements
- Studies show that caffeine ingestion increases energy expenditure approximately 13%
- No, that DOESN'T mean you can have a piece of cheesecake with your coffee!

Caffeine

- People differ greatly in their sensitivity and reactions to caffeine depending on a number of variables:
 - Amount ingested
 - Frequency of consumption
 - Health status
 - Detoxification status



Route of Administration

- Oral administration
 - Beverages: Coffee, tea, cocoa, chocolate milk, cola, energy drinks
 - Chocolate
 - OTC preparations
 - Stimulants
 - Pain-killers (caffeine synergizes acetylsalicylic acid or aspirin)
 - Diuretics and cold preparations



Coffee and Diabetes

- Recent research has shown that long-term coffee consumption is associated with a statistically significantly LOWER risk for type 2 diabetes



Type 2 Diabetes

- A systematic review of 9 cohort studies compared minimal to low coffee consumption (<2 cups/day) with that of heavy coffee consumption (≥ 6 cups/day) for the risk of the development of type 2 diabetes mellitus
- These researchers concluded that the risk of the development of T2DM was lowest in subjects who drank >6 cups daily and also was significantly reduced for subjects who consumed 4 to 6 cups daily
- A prospective study of >88,000 women 26 to 46 years of age established a linear relationship of coffee consumption with the reduction in T2DM, whereby even small amounts of coffee on a daily basis conferred benefit.
- Associations were similar for decaf and caffeinated coffee.

Increased coffee consumption may reduce the risk of Type 2 Diabetes

- The Harvard School of Public Health (HSPH) researchers gathered data from 3 studies.
- In these studies, the diets of the participants were evaluated using questionnaires every 4 years, with participants who reported having type 2 diabetes filling out additional questionnaires. In total, 7,269 study participants had type 2 diabetes.
- The researchers found that the participants who increased their coffee intake by more than one cup a day (on average, an increase of 1.69 cups per day) over a 4-year period had an 11% lower type 2 diabetes risk over the subsequent 4 years, compared with people who did not change their intake.

Caffeine and blood sugar

- But it's a bit of a paradox.
- Studies around the world consistently show that high consumption of caffeinated or decaffeinated coffee is associated with low risk of type 2 diabetes.
- But if you look at acute studies that just give people caffeine or caffeinated coffee, and then have them eat something rich in glucose, their sensitivity to insulin drops and their blood glucose levels are higher than expected.

Can Raise Blood Sugar

- Even if you don't add any sugar to your morning cup of coffee or tea, it can still drive up your blood glucose level.
- The caffeine in these drinks exaggerates the body's response to carbohydrates, causing blood sugar to rise more than it normally would after meals.
- A Duke University study of regular coffee drinkers with type 2 diabetes found that taking 500 milligrams of caffeine — the equivalent of three to five cups of java, depending on the strength — increased average blood sugar over the course of the day by 7.5%

Caffeine and High Blood Pressure

- *Studies show that if people are not used to using any caffeine, and they start to use caffeine, their blood pressure goes up substantially.*
- *Within a week of caffeine consumption, however, the effect is less pronounced—there is less of an increase in blood pressure.*
- *After several weeks of continued caffeine consumption, however, a little bit of increase in blood pressure remains.*
- *In studies that look at the incidence of hypertension in the general population, drinking caffeinated coffee is not associated with an increase in risk.*
- *But if people have hypertension, and are having a hard time controlling their hypertension, they could try switching from caffeinated coffee to decaffeinated coffee, to see if it has a beneficial effect.*

Caffeine and High Blood Pressure

- A recent meta-analysis of 10 randomized, controlled trials and 5 cohort studies assessed BP and the incidence of HTN in coffee consumers.
- Non-significant changes in blood pressure were noted in coffee drinkers compared with the control group.
- Evidence analyzed from this large study showed no clinically important effects of long-term coffee consumption on BP or risk of HTN.
- Studies and reviews done previously have also come to similar conclusions.
- The Nurses' Health Study, with 1.4 million person-years of follow-up, demonstrated that daily intake of up to 6 cups of coffee was not associated with an increased risk of HTN

Caffeine and High Blood Pressure

- However, combining a caffeine habit with work stress may affect blood pressure more significantly in hypertensive individuals since caffeine raises blood pressure by elevating vascular resistance
- This effect is larger and more prolonged in hypertensive adults
- 3 cups of coffee can raise cortisol, a stress hormone that causes blood vessels to constrict and compels the heart to pump harder, raising blood pressure

Caffeine and Heart Health



- Cardiovascular disease is the #1 killer in the United States, accounting for nearly half of all deaths
- Early research found that a caffeine habit could exacerbate already-existing high blood pressure
- However, this effect has only been observed in non-habitual coffee drinkers
- Restriction of coffee or caffeinated beverages is no longer justified for people with high blood pressure

Caffeine and Heart Health



- In fact, no clear association between coffee and risk of high blood pressure, myocardial infarction (heart attack) or other cardiovascular diseases has been demonstrated
- In contrast to early studies, recent research indicated that habitual moderate coffee intake does NOT represent a health hazard and may even be associated with beneficial effects on cardiovascular health

Coronary Heart Disease

- A meta-analysis of 21 independent prospective cohort studies from January 1966 to January 2008 suggested that moderate coffee consumption may decrease the long-term risk of CHD (coronary heart disease)
- In this study, 15,599 CHD cases developed in 407,806 participants. Compared with the light-to-absent coffee consumption (<1 cup/day in the United States or ≤2 cups/day in Europe), moderate coffee consumption (>1 or 2 cups daily, respectively) was associated with significantly lower rates of CHD in the entire group of men and women
- A more recent study showed that acute caffeine ingestion significantly decreased high-sensitivity C-reactive protein levels in 2 groups of patients with and without CHD compared with placebo.

Stroke

- Coffee may reduce the risk of ischemic stroke.
- A recent meta-analysis of 7 prospective studies with 442,098 participants: 6,962 stroke events, and follow-up of 2 to 24 years demonstrated that 1 to 3 cups of coffee were associated with a decreased risk of stroke.
- The evaluation of the risk of stroke in the general population consuming 3 to 6 cups of coffee per day showed a significant reduction
- By contrast, habitual consumption of >6 cups of coffee per day was not associated with any effect on stroke risk
- The authors concluded that coffee consumption is not associated with a higher risk of stroke and that habitual moderate consumption may exert a protective effect.

Cholesterol

- After extensive research into different methods of coffee preparation, researchers have determined that coffee's potential effects on cholesterol levels depend on how it is prepared
- The terpene lipids cafestol and kahweol make up about 1% of coffee seeds and have been implicated in raising serum cholesterol
- Terpenes are oils created when coffee grounds mix with hot water

Cholesterol

- Of the two lipids, cafestol is considered the more insidious and is present in higher concentrations in arabica coffees
- The longer the hot water and coffee grounds are in contact, the more terpenes are generated and the more likely they are to affect cholesterol
- Various methods of coffee preparation result in differing levels of terpenes

Cholesterol

- Turkish-style “mud” coffee contains the highest amounts of cafestol and kahweol
- Espresso has high levels of terpenes and a moderate effect on cholesterol levels
- Filtered coffee is believed to have little or no effect on serum cholesterol. If you use a “drip” coffee maker, be sure to use non-bleached filters. The bright white ones, which most people use, are chlorine bleached and some of this chlorine will be extracted from the filter during the brewing process.
- Unfiltered coffee increases serum levels of total and LDL cholesterol but filtered coffee does not
- Percolated coffee is low in terpenes even though this type of coffee is boiled and unfiltered
- Instant coffee has little or no effect on cholesterol (contains almost no cafestol or kahweol)
- Decaffeinated coffee and regular coffee have equal amounts of terpene levels (so most likely not the caffeine that alters cholesterol)

Memory

- Researchers from the University of Innsbruck in Austria found that caffeinated coffee can *temporarily* sharpen a person's focus and memory
- After giving volunteers the caffeine equivalent of about two cups of coffee, they used magnetic resonance imaging to observe that the volunteers' brain activity was increased in two locations, one of which is involved in memory.
- Volunteers given no caffeine showed no increase in brain activity.

Memory

- Another study, published in a leading neurology journal, found that the effects of caffeine may be longer lasting in women.
- This four-year-long study involved about 7,000 participants who all went through baseline evaluations for cognitive function and blood pressure, cholesterol levels, and other vascular issues.
- The researchers reevaluated the participants at the end of two years and again at the end of four years; they found that women 65 and older who drank more than three cups of coffee per day (or the caffeine equivalent in tea) had about a third less decline in memory over that time than the women who drank one cup or less of coffee (or the caffeine equivalent in tea) per day.
- The results held up even after the researchers adjusted them to take into account other factors that could affect memory function, such as age, education, baseline cognitive function, depression, high blood pressure, high cholesterol, medications, and chronic illnesses.
- The researchers speculated that this caffeine-memory association was not observed in men because it's possible that the sexes metabolize caffeine differently.

Alzheimer's and Parkinson's

- Research also shows other beneficial health effects of coffee:
- May reduce risks of Alzheimer's dementia and other diseases of the central nervous system including Parkinson's disease
- Research in this field is ongoing but looking very positive

Parkinson's

- Researchers in the U.S. carried out a study that assessed the link between coffee consumption and Parkinson's disease risk.
- Reported in JAMA, the authors of the study concluded that "higher coffee and caffeine intake is associated with a significantly lower incidence of Parkinson's disease"
- In addition, caffeine in coffee may help control movement in people suffering from Parkinson's, according to a study conducted at the Research Institute of the McGill University Health Centre that was published in the journal *Neurology*.

Cancer

- Cancer accounts for 1 in every 4 deaths in the US
- Second-leading killer in US
- Based on current scientific evidence, the American Cancer Society reports that there appears to be "no relationship at all" between coffee and any type of cancer
- In fact, coffee may protect against certain cancers

Colorectal Cancer

- Several studies suggest that coffee intake may be inversely related to risk of colorectal cancer (3rd most common malignancy in terms of new cases and deaths)
- In one study, consumption of caffeinated coffee, tea or caffeine was not associated with incidence of colon or rectal cancer
- Regular consumption of decaffeinated coffee was associated with a reduced incidence of rectal cancer

Colorectal Cancer

- Coffee neutralizes heterocyclic amines, carcinogens that form when meat is cooked
- Heterocyclic amines have been implicated in colon cancer
- Regular and decaf coffee also promote colonic motility and speed elimination of cholesterol, bile acids and metabolites – substances which may increase the risk of colon carcinogenesis

Liver Cancer

- Coffee consumption reduces risk of hepatocellular carcinoma (HCC), the most common type of liver cancer, by about 40%, according to an up-to-date meta-analysis published in *Clinical Gastroenterology and Hepatology*, the official clinical practice journal of the American Gastroenterological Association.
- Further, some data indicate that three cups of coffee per day reduce liver cancer risk by more than 50%.
- “The favorable effect of coffee on liver cancer might be mediated by coffee’s proven prevention of diabetes, a known risk factor for the disease, or for its beneficial effects on cirrhosis and liver enzymes“ said Carlo La Vecchia, MD, study author
- Liver cancer is the 6th most common cancer in the world, and the 3rd most common cause of cancer death.

Breast Cancer

- Breast cancer affects nearly 1 in 9 women in the US
- Coffee, tea and caffeine have been suspected of having a role in breast carcinogenesis or in the promotion or inhibition of tumor growth
- A review of the research concluded that most epidemiological studies have NOT found any association
- One recent study from Sweden found no association between breast cancer and the consumption of coffee/tea
- Green tea is often recommended for women with breast cancer

Gall Bladder Disease

- Recent studies have shown that the consumption of caffeinated coffee may play a role in the prevention of symptomatic gallstone disease in women
- Past studies have shown that coffee may help prevent gall bladder disease in men
- Studies indicate there is an inverse relationship between the consumption of caffeinated beverages and risk of gallstones
- The greater the caffeine consumed, the greater the effect
- Decaf did NOT produce the same results

Headache Relief

- Caffeine helps some people get relief from headache pain (migraine or tension-type)
- Research suggests that OTC analgesics like aspirin, ibuprofen and acetaminophen are 40% more effective when used with caffeine
- 1998 *JAMA* study of people with chronic migraines concluded that this combination leads to “significantly greater reductions in migraine headache pain intensity”

Asthma Relief

- Italian researchers observed an inverse correlation between symptoms of bronchial asthma and coffee intake
- Bronchodilating effects not only reduce asthma symptoms, but may even prevent clinical manifestation of the illness
- Caffeine raises the levels of epinephrine and norepinephrine in the blood, relaxing smooth muscle in the airways of the lungs, making breathing easier

Asthma Relief

- Structurally similar to caffeine, theophylline was developed into one of the first effective therapies for asthma in the 1940s
- Today, theophylline remains the most widely prescribed drug for the treatment of airway disease world-wide
- Like caffeine, theophylline stimulates the heart and respiratory system and relaxes smooth muscle tissue
- Very effective in treating moderate to severe asthma – reduces airway inflammation

Depression

- Coffee may reduce the risk of depression, a known risk factor for the development of CV disease, as well as an independent predictor of poor prognosis.
- In a recent longitudinal study of 50,739 women, ingesting ≥ 4 cups of coffee daily significantly decreased the incidence of depression
- The effect may be due largely to the caffeine content because women consuming decaffeinated coffee did not show a reduced risk.

All Cause Mortality

- In the National Health and Nutrition Examination Survey, 6,594 participants 32 to 86 years of age with no history of CV disease at baseline were prospectively followed for 8.8 years.
- Coffee intake of participants who were 65 years of age or older exhibited a dose-response protective effect whereby increasing habitual consumption of coffee was associated with lower risk of adverse CV events and heart disease mortality
- In another study, 41,736 men and 86,214 women with no history of CV disease or cancer at baseline were followed for 18 years (men) and 24 years (women) to assess the association between coffee consumption and CV mortality, cancer, and all-cause mortality.
- An inverse association between coffee consumption and all-cause mortality was seen mainly due to a moderately reduced risk of CV disease mortality and was independent of caffeine intake; decaffeinated coffee was also associated with a small reduction in all-cause and CV disease mortality.

All Cause Mortality

- In the recent National Institutes of Health-AARP Diet and Health Study, 229,119 men and 173,141 women were followed from 1995 through 2008 to examine the association of coffee drinking with subsequent total and cause-specific mortality.
- Inverse associations were observed for deaths due to heart disease, respiratory disease, stroke, injuries and accidents, diabetes, and infections, but not for deaths due to cancer for both regular and decaf coffee

Antioxidant Properties

- Coffee is the #1 source of antioxidants in the diet in the US!
- Caffeine has strong antioxidant properties
- If present during times of oxidative stress, caffeine may help slow or prevent oxidation of blood lipids
- Oxidation is a process that, if unchecked, can contribute to arterial plaque formation and other degenerative changes

Caffeine

- Caffeine works best as a stimulant when you take it on an intermittent, off-and-on basis.
- Higher doses can have much more potent effects. A dose of 500 mg or 600 mg of caffeine can affect you much like a low dose of an amphetamine.
- The effects of caffeine wear off quickly when you use it regularly.
- Your body builds up a tolerance to it.

Caffeine



- Caffeine levels vary widely from one product to another.
- In particular, the caffeine content of coffee can be very unpredictable.
- Scientists at the University of Florida bought a 16-oz cup of the same type of coffee from one coffee shop for six straight days.
- They analyzed each cup of coffee to determine how much caffeine it contained.
- They found a wide range of caffeine levels in the six cups of coffee.
- The lowest level was 259 mg of caffeine and the highest was 564 mg.

Caffeine Content

- Dunkin Donuts coffee with turbo shot ● 436 mg caffeine
- Starbucks Coffee Venti ● 415
- Starbucks Coffee Grande ● 225
- Panera Coffee ● 189
- Starbucks Espresso Frappuccino, Venti ● 185
- Folgers Classic Roast Instant ● 148
- Maxwell House Decaf ground ● 2-10
- Black Tea ● 30-80
- Green tea ● 35-60
- Herbal Tea ● 0



Caffeine Content

- Pepsi Max (all 12 oz) ● 69 mg
- Mountain Dew, Reg/Diet ● 54
- Diet Coke ● 47
- Dr. Pepper ● 41
- Pepsi ● 38
- Coco-Cola, Coke Zero, Diet ● 35
- 7 up, Fresca, Sprite ● 0



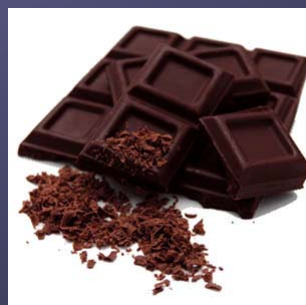
Caffeine Content

- Jolt Energy Drink 23.5 oz ● 280 mg
- Rockstar Citrus Punched 16 oz ● 240
- 5-hour Energy 1.9 oz ● 208
- Monster Energy 16 oz ● 160
- Rockstar 16 oz ● 160
- Red Bull 8.4 oz ● 80
- V8 V-Fusion+Energy 8 oz ● 80
- Vitaminwater Energy 20 oz ● 80



Caffeine Content

- Starbucks hot chocolate 16 oz ● 25 mg
- Hershey's special dark chocolate bar 1.5 oz ● 20
- Hershey's milk chocolate bar 1.6 oz ● 9
- Hershey's Kisses 9 pieces ● 9
- Hershey's Cocoa 1 Tbsp ● 8
- Hershey's Chocolate lowfat milk 12 oz ● 2



Caffeine Content

- Zantrex-3 weight loss supplement 2 capsules ● 300 mg
- NoDoz or Vivarin 1 caplet ● 200
- Excedrin Migrane 2 tablets ● 130
- Midol Complete 2 caplets ● 120
- Bayer Back and Body 2 caplets ● 65
- Anacin 2 tablets ● 64
- Jolt Gum 1 piece ● 45



Coffee Drink Calories

- A 24-ounce mocha Frappachino at Starbucks with whipped cream has almost 500 calories—that's 25% of the daily calorie intake for someone who requires 2,000 calories a day



Dependence/Withdrawal

- Moderate caffeine consumption is safe and should not be classified with addictive drugs of abuse
- When regular caffeine consumption is abruptly discontinued, some people may experience temporary withdrawal symptoms (caffeine headache)

Iron and Calcium

- Coffee likely reduces the body's absorption of iron and calcium
- If you are a heavy coffee drinker, make sure your diet includes adequate sources of those nutrients
- Try not to ingest foods with iron and calcium while drinking coffee

Sleep



- If you have difficulty falling or staying asleep or sleeping restfully, consider how coffee may aggravate these ailments
- Cutting down on caffeine especially late in the day, may help
- Try grain-based coffee substitutes like Postum, Chicory, or Teeccino

Tea



- Aside from water, tea is the most commonly consumed liquid on earth
- Numerous medicinal benefits mainly due to its antibacterial and antioxidant properties
- All real tea comes from the plant *Camellia sinensis*
- 3 types: *black, green, oolong*

Tea



- Green tea is the least processed of all teas
- Green tea contains a variety of biologically active compounds such as polyphenols, methylxanthines, essential oils, proteins, vitamins and amino acids
- Most of its physiological effects, such as reducing plasma lipid levels and anti-inflammatory, antimicrobial, anticancer and antioxidant activities are related to tea catechin

Tea

- All 3 types of tea have health benefits
- Darker varieties of tea have less antioxidant and antibacterial properties
- Oolong is more processed than green tea but less than black
- The antioxidizing effects of both black and green teas are reduced when taken with milk
- Protein in milk is thought to bind to flavonoids, reducing their effectiveness

Tea

- Catechins include epigallocatechin gallate – EGCG
- Green tea has been shown to help:
- Improve glucose intolerance
- Reduce risk of type 2 diabetes
- Ease GI disturbances
- Help maintain bone mineral density
- Help in weight loss
- Lower risk for some cancers



Caffeine & Performance

- May increase alertness and enhance performance
 - Improved physical endurance
 - Enhanced mental abilities
 - Caffeine is ergogenic (improves physical performance), helping you to perform difficult physical tasks by eliminating fatigue.
 - It also increases the amount of adrenaline in your system, causing a rush of extra glucose and oxygen to your muscles.

Caffeine and Exercise

- Caffeine is thought to help endurance athletes by reducing the muscles' consumption of glycogen, the stored energy used up during exercise.
- There's only a certain amount of glycogen available, and once it's used up, muscle fatigue sets in.
- Caffeine is thought to delay the onset of muscle fatigue by helping your body use its own fat reserves as energy instead, reducing the glycogen burn rate.
- This is known as "glycogen sparing." The longer your glycogen lasts, the longer your muscles can function.
- Caffeine consumed during a marathon has also been found to be an effective aid, helping to release pain-reducing endorphins as well as reducing mental fatigue.

Caffeine and Exercise

- Caffeine's major benefit in the short term may lie in the reduction of lactic acid.
- Lactic acid builds up in the muscles as glycogen is depleted.
- It's the source of the burning sensation you feel in your muscles during a workout.
- A 2009 study at the University of Illinois found that 300 milligrams of caffeine taken prior to a workout reduced the amount of burning felt by the subjects in the study.
- Caffeine also seems to affect the ratio of calcium and potassium ions in muscle cells, making it easier for muscle cells to contract and produce more power.

Questions About Caffeine & Health Issues

- Osteoporosis: Adequate calcium consumption, such as a small amount of milk, offsets potential effect of caffeine on bone density
- Studies show that high caffeine intake (more than four cups of coffee per day) inhibits calcium absorption and leads to calcium loss through the urine
- 1-3 cups coffee per day is OK



Questions About Caffeine & Health Issues

Hydration:

- Anecdotal reports that caffeine “causes dehydration” exaggerate the facts
- Caffeine consumption does stimulate mild diuresis, but this is usually offset by the liquid with which it is typically consumed
- Tolerance to caffeine reduces the chance of fluid imbalance



Anxiety

- According to a study by researchers at the University of Oklahoma, "caffeine can cause anxiety symptoms in normal individuals, especially in vulnerable patients, like those with pre-existing anxiety disorders."



POTENTIAL DANGERS / NEGATIVE CONSEQUENCES OF CAFFEINE

- Alcohol and Caffeine
- Caffeine acts as antagonists, masking the feeling of intoxication
- May mask negative side-effects of alcohol (ex: headaches, dizziness, etc.)
- Unable to mask psychomotor impairments
- Tendency to consume more alcohol when combined with caffeine
- Can lead to "toxic jock syndrome" = more risk taking

THE U.S. CAFFEINATED CRAZE -

- Over 500 new brands launched in 2006
- Over 1,000 brands worldwide in 2010
- U.S. retail market exceeds \$5 billion annually
- Caffeine ranges 50mg – 505mg per can/bottle
- Other ingredients:
 - Taurine, guarana, riboflavin, nicotinamide, B vitamins, other herbal supplements... & lots of sugar usually!



- Caffeine Pills
- On average 100mg – 200mg per dosage
- Weigh-loss agent
- Popular brands include: No-Doze,
- Caffeine Candy and Food
- New breed of caffeine-spiked candies and
- foods
- Invigorated with 100+mg of caffeine per serving



Caffeine/Drug Interactions

- A total of **82 drugs** (406 brand and generic names) are known to interact with caffeine
- The “human polycyclic aromatic hydrocarbon-inducible cytochrome P450(CYP1) family” of enzymes, otherwise called “CYP450” enzymes metabolize caffeine
- When a drug/medication is metabolized by a CYP450 enzyme, the amount of CYP450 available can determine the speed with which the medication/drug is cleared from the body.
- Some medications compete with each other for CYP450 enzymes, while others increase or decrease the production of these enzymes, and, in each case, the rate of clearance of the medications in question is correspondingly increased or decreased.

Caffeine/Drug Interactions

- CYP450 enzymes have many functions in addition to metabolizing drugs.
- They also metabolize environmental toxins, dietary components, and various endogenous substances (e.g., steroids, prostaglandins) that are produced within the body, and the activity of these substances is also a factor in determining the speed at which various drugs are cleared from the body.

Caffeine/Drug Interactions

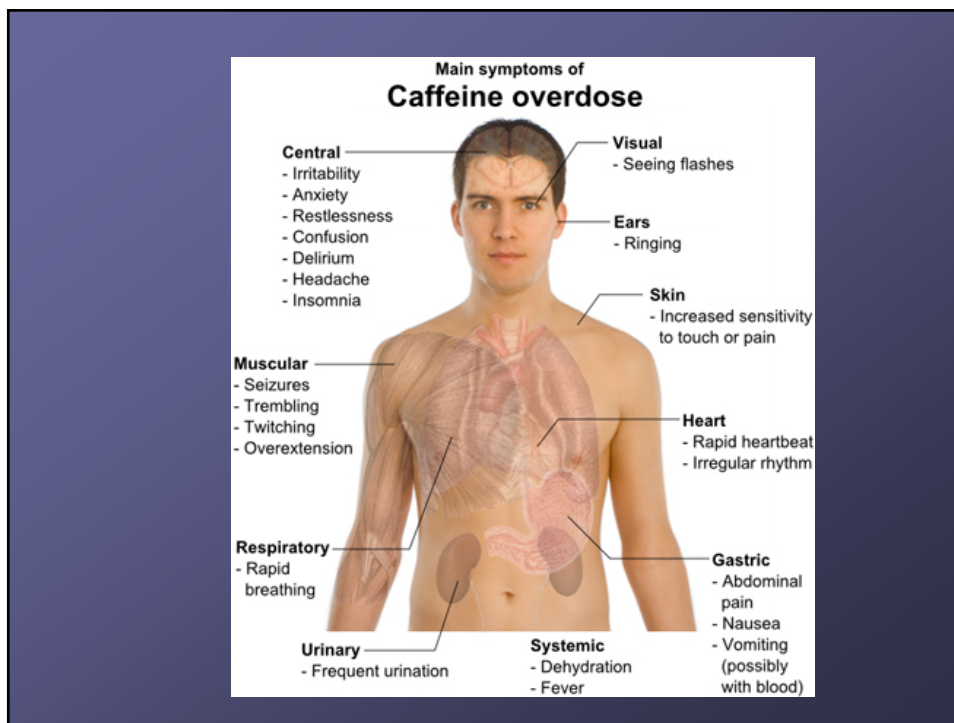
- Caffeine is metabolized by the liver enzyme CYP1A2. However, CYP1A2 exhibits pronounced inter-individual *variation* in activity.
- The speed with which caffeine is cleared from the body is proportional to the amount of available CYP1A2, and highly variable activity levels of the enzyme means highly variable half-life for caffeine users.
- That's one reason that two cups of coffee in the late afternoon might not keep you awake at night, while one cup in the late morning can disturb your neighbor's sleep.

Caffeine/Drug Interactions

- Other drugs metabolized by this enzyme include warfarin, and several antidepressants and antipsychotics.
- When caffeine is introduced, there is less of the enzyme available to metabolize these drugs.
- What this means is that each acts as a metabolic inhibitor—and sometimes as a very potent metabolic inhibitor—of the other, slowing down the speed with which the body can “break down” or eliminate the drugs.
- The result is that blood level of these drugs, or of caffeine, or of both increases.
- For example, a woman who was a heavy coffee drinker who was also taking clozapine (an anti-schizophrenic medication) was found to have about 2 ½ times higher blood levels of the drug when she took caffeine. Because schizophrenic patients commonly consume remarkably high doses of caffeine, such interactions could conceivably constitute a relatively common problem for patients taking that medication.

Caffeine/Drug Interactions

- Alternatively, other drugs can inhibit the production of CYP1A2 and in this way dramatically slow the metabolism of caffeine and inhibit the clearance of caffeine from the body.
- Several antibiotics and antidepressants are potent inhibitors of several CYP450 enzymes, including CYP1A2.
- For example, the selective serotonin reuptake inhibitors Prozac (fluoxetine), Paxil (paroxetine), and Luvox (fluvoxamine), commonly used to treat depression, social anxiety, and obsessive eating disorders, are inhibitors of the CYP1A2, and therefore interfere with the body's ability to catalyze the biotransformation of caffeine.
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CAFFEINE REGULATION

- FDA – Regulated as a Food
- What are the labeling requirements
- Must be listed in ingredients list when used as an additive
- Does not apply to naturally occurring caffeine products
- FDA does not require disclosure of caffeine quantity in food products
- Example – Soda states “caffeine” in ingredient list, but not amount



Conclusion

- Caffeine is a mixed bag
- Caffeine has both positive and negative health effects
- People can react very differently to it because some people are more sensitive to caffeine than others
- Like most things in life – moderation is key to enjoyed the benefits and avoiding the negative consequences!

● Let's Get Cooking!

