

Tea Fact Sheet – 2021

Tea is the most widely consumed beverage in the world next to water, and can be found in almost 80% of all U.S. households. It is the only beverage commonly served hot or iced, anytime, anywhere, for any occasion. On any given day, over 159 million Americans are drinking tea.

**Annual Consumption:
(U.S.)**

In 2020, Americans consumed over 84 billion servings of tea, or more than 3.8 billion gallons. About 84% of all tea consumed was black tea, 15% was green Tea, and the small remaining amount was oolong, white and dark tea.

Year-on-year, imports are lower than 2019, due to the COVID and its impact on the foodservice sector. Both green and black teas were lower vs. 2019. However, in-home consumption of tea grew some 18%, with stay-at-home orders incentivizing consumers to drink tea to ease stress, relax, calm and center them.

The U.S. continues as the third largest importer of tea in the world after Russia and Pakistan, and literally the only western country to grow in both tea imports and consumption.

More than four in five consumers drink tea, with Millennials being the most likely (87%+ of millennials drink tea).

**Daily Consumption:
(U.S.)**

On any given day, more than one half of the American population drinks tea. On a regional basis, the South and Northeast have the greatest concentration of tea drinkers.

Iced Tea Consumption:

Approximately 75 - 80% of tea consumed in America is iced.

Ready-To-Drink Iced Teas:

The RTD tea category growth resumed with a estimated growth of some 3 – 5%, despite competition from other beverages and COVID impacts.

Tea Bags, Herbal & Loose Tea:

The bagged/loose leaf tea segment through traditional channels had unprecedented growth as consumers turned to tea during the pandemic. This segment continues to be important in introducing new consumers to tea and tea's ability to calm and center supported some 18 – 20% year on year growth. The Foodservice sector was decimated, as restaurants,

hotels and vacation destinations were closed. It is estimated that this segment declined some 50 – 70%. High-end specialty teas continue to grow at accelerated rates, helping to expand the total market.

Current Sales:

In 2020, total U.S. black and green tea imports were 233 million pounds. This represents a decline vs. 2019 of some 10.4%.

Hot tea and specialty tea continue their growth and appeal to consumers

Green tea remains at ~15.% of total tea imports.

**Anticipated Sales:
(U.S.)**

Despite the impact of COVID and reduced imports, the tea industry continued its growth, with an anticipated CAGR of 1-3%. This growth is expected to accelerate in 2021 as the increased at home consumption will translate to increased out of home once the foodservice segment re-opens. Tea's variety, convenience, health benefits, sustainability, availability, continued innovation and the discovery of unique, flavorful and high-end specialty teas will provide the fuel. Long term success relies on the continued adoption of tea by new consumers who continually seek healthy food and beverage choices. We are seeing this exact behavior, particularly from Millennials, Gen Z's and Baby Boomers

Varieties:

Black, green, oolong, dark and white teas all come from the same plant, a warm-weather evergreen named *Camellia sinensis*. Differences among the five types of tea result from the various degrees of processing and the level of oxidization. Black tea is fully oxidized and oolong teas are partially oxidized. After withering and rolling, the tea leaves undergo natural chemical reactions resulting in taste and color changes which develop the tea's distinguishing characteristics. Green & white teas are not oxidized after leaf harvesting. Oolong tea's level of oxidation is midway between that of black and green teas, and also lie in the middle in its strength and color. Dark teas may or may not be oxidized, but are microbially fermented after manufacture.

Grown In:

Much of the world's tea is grown in mountainous areas 3,000 – 7,000 feet above sea level, situated between the Tropics of Cancer and Capricorn in mineral-rich and acidic soil. Over 30 countries grow tea with leading tea-producing countries being Argentina, China, India, Indonesia, Japan, Kenya, Malawi, Sri Lanka, Tanzania, Taiwan and Vietnam.

History:

Tea is nearly 5,000 years old, purportedly discovered in 2737 BC by Chinese Emperor Shen-Nung, aka "The Divine Healer". As

legend tells us, some tea leaves accidentally blew into the Emperor's pot of boiling water and created the first tea brew. According to Chinese tea scholars, the Emperor, as a botanical explorer, accidentally poisoned himself some 85 times, each time being cured by this wonderful brew.

In the 1600's, tea became highly popular throughout Europe and the American colonies. Tea played a dramatic part in the establishment of the United States of America. In 1767 the British Government passed the Revenue Act (one of the Townshend Acts) putting a tax on tea, as well as any British china, glass, lead, paint and paper, imported to America. In 1770, after much protest, the Townshend Acts were repealed and all taxes removed with the exception of the tax on tea. In 1773, the passage of the Tea Act, granting a monopoly to the British East India Company on all tea sales to the American Colonies, effectively raised tea prices. Protesting this monopoly, which drove tea prices higher, as well as "taxation without representation" re: the tax on tea by Parliament, an incensed group of colonists, the Sons of Liberty, took actions in their own hands. On the night of December 16, 1773, men dressed as Native Americans (Mohawk Indians) boarded British ships in Boston Harbor and threw more than 300 chests of tea into the sea. While not the only instance of tea being thrown overboard or otherwise destroyed in protest throughout the colonies, this most famous Boston Tea Party was said to be a principle act leading to the Revolutionary War.

Anna, Duchess of Bedford, is credited with creating *Afternoon Tea* in 1840, when she began taking tea with a light snack around 4:00 p.m. to ward off "that sinking feeling."

High Tea originated with the rural and working-class British, who would return to their homes at about 6:00 p.m. for a meal of potted meats, fish, cheese, salads, sweets, and a pot of strong tea. The U.S. played a significant role in the history of tea, inventing the tea bag and popularizing iced tea in 1904. Recently, the U.S. has led the rest of the world in marketing convenient ready-to-drink forms of tea in bottles and cans. The U.S. is also the only country in the world that consumes the majority of its teas chilled.

Environmental Qualities:

Tea is an all-natural and environmentally sound product from a renewable source. Tea supports sustainability in three ways: ecological, social and economic. Hundreds of thousands of workers are involved with the growing, production and manufacturing of the tea that you consume every day. The tea plant is naturally resistant to most insects; oxidation of the tea leaf is a natural process; and, many tea packers use recycled paper for packaging.

Health Qualities:

Tea is a refreshing beverage that contains no sodium, fat, carbonation, or sugar. It is virtually calorie-free. Tea helps maintain proper fluid balance and may contribute to overall good health.

Tea contains flavonoids, naturally occurring compounds that are believed to have antioxidant properties. Tea flavonoids often provide bioactive compounds that help to neutralize free radicals, which scientists believe, over time, damage elements in the body, such as genetic material and lipids, and contribute to chronic disease.

Every day, new findings from the international scientific community lend credibility to tea's healthy properties. Recent research has explored the potential health attributes of tea through studies in humans, animal models and through *in vitro* laboratory research. For the most part, studies conducted on green and black tea, which are both from the *Camellia sinensis* plant, have yielded similar results. Recent research suggests that tea and tea flavonoids may play important roles in various areas of health and may operate through several different mechanisms still being explored.

Research continues, and the list of key areas of research are as follows:

Heart Health:

Human population studies have found that people who regularly consume three or more cups of black tea per day have a reduced risk of heart disease and stroke.¹⁻⁵ A 2020 review found adults who drink 2-3 8 oz. cups of tea per day may lower their risk of death from heart disease by approximately 8-12% and may lower their risk of all-cause mortality by approximately 4-6%, compared to nonconsumers.⁶ Each 8 oz. cup of tea consumed by those over 65 years old was associated with a 10% lower risk of death from heart disease.⁶ The current body of research suggests that drinking tea can offer significant heart health benefits including reducing the incidence of cardiovascular events, slowing the progression of disease, lowering Low Density Lipoprotein (LDL) cholesterol, or "bad" cholesterol, and improving blood pressure – with benefits seen with just one cup and upwards of six cups a day. Using survey data from Multi-Ethnic Study of Atherosclerosis, a 2016 investigation found that those who drank more than one cup of tea per day had a lower incidence of cardiovascular events and a slower progression of coronary artery calcification.⁷ This result is supported by other cohorts.^{8,9} For example, data from the Dongfeng-Tongji cohort, found that of the 19,471 middle-aged and older Chinese individuals who drank green tea (~36%

of participants) had a reduced risk of coronary heart disease (CHD). After 5-year follow-up there were significantly lower levels of total cholesterol, LDL, and mean platelet volume and increased HDL and uric acid levels among green tea consumers.^{8,9}

A Harvard study found that those who drank a cup or more of Black tea per day had a 44% reduced risk of heart attack.¹⁰ In a large population-based study published in the *Journal of the American Medical Association*, found that adults who drank just over two cups of Green tea per day reduced their risk of death from cardiovascular disease by 22-23%.¹¹ A U.S. Department of Agriculture study found that participants who consumed five cups of Black tea per day along with a diet moderately low in fat and cholesterol reduced their LDL cholesterol by about 11% after three weeks.¹² Additionally, a study published in the December 2013 issue of the *American Journal of Clinical Nutrition* found that Black tea reduced blood pressure, and among hypertensive subjects, it helped counteract the negative effects of a high-fat meal on blood pressure and arterial blood flow.¹³

Certain Cancers:

More than 3,000 published research studies have evaluated the effect of tea—White, Green, Oolong or Black—and tea compounds, such as epigallocatechin gallate (EGCG), on the risk of a variety of cancer types. A study published in the February 2015 issue of the *Journal of Molecular Nutrition and Food Research* found that the main antioxidant in Green tea, epigallocatechin-3-gallate (EGCG), helps kill cancer cells through the destruction of the cells' mitochondria.¹⁴ Research has also identified an association between amount and duration of tea consumption and gastrointestinal cancer risk. One study found that women who consumed the equivalent of 2.5 cups of tea per day had a 60% reduction in rectal cancer risk, compared with women who drank less than 1.2 cups of tea daily.¹⁵ Another study found tea drinkers to have a 42% reduced risk for colon cancer compared to non-tea drinkers. Men who drank more than 1.5 cups of tea per day were found to have a 70% lower colon cancer risk.¹⁶ An animal study suggests that 500 mg/kg/day of Niaowangzhong Green tea extract may be chemo preventive for digestive and intestine cancers.¹⁷

Tea consumption has been linked to lower skin cancer risk. One study showed that participants who drank iced Black tea and citrus peel had a 42% reduced risk of skin cancer and hot Black tea consumption was associated with a significantly lower risk of the most common form of skin cancer, squamous cell carcinoma.^{18,19} More recently, Green tea polyphenols have

been suggested as a chemo protective or chemotherapeutic option in skin cancer. A recent review paper of *in vitro*, *in vivo* and human studies highlights the various mechanisms by which consumption of Green tea and topical application may have preventative effect against skin cancer. EGCG, along with other polyphenols, act by increasing DNA repair mechanisms, reducing UVB mediated inflammation and oxidative stress and down regulating pathways involved in carcinogenesis. Green tea polyphenols EGCG may also suppress the action of p53, which is involved in tumor suppression. Studies have shown that the topical application, as well as dietary supplementation of Green or white tea extracts may protect the skin from UV damage by increasing DNA repair. Last, epigenetic modification is caused by UVB exposure, research shows that EGCG may reduce tumor incidence and decrease tumor multiplicity and size.²⁰

Scientists suggest that EGCG, in addition to its antioxidant and anti-inflammatory properties, may act at various points in the cell cycle and control apoptosis.²¹⁻²³ Using bioinformatics, researchers Xinqiang et al analyzed the targets of epigallocatechin-3-gallate (EGCG) on human genes through an Ingenuity Pathway Analysis which suggests that EGCG acts on several genes involved in the cell cycle, cell growth and proliferation, cell survival and death and DNA replication in ovarian cancer.²¹ A recent review of *in vivo*, *in vitro* and clinical trials by Rahmani et al demonstrated that Green tea may suppress tumor growth. Notably, the clinical trials reviewed indicated that green tea may specifically slow prostate cancer progression.²² EGCG was shown to have an anti-carcinogenic effect on cervical cancer. This review illustrated that EGCG may modify several critical processes in the cell cycle as well as induce cervical cancer cell apoptosis and inhibit telomerase activity.²³

Neurological Decline:

Research has identified several modifiable factors that may help slow the progression or reduce the risk of age-related neurological declines and diseases.^{24,25} Tea may be one of the modifiable factors as the antioxidants in tea may protect brain cells from environmental insults from free radical exposure.²⁶⁻²⁸ In addition, L-theanine in tea has been shown to directly affect areas of the brain that control attention and ability to solve complex problems.²⁹⁻³¹ A study of The Ohsaki Cohort suggested that Green tea consumption (of 5 cups of tea daily vs. 1 cup) was associated with lower risk of incident dementia or new diagnosis of dementia.³² A long-term study of nearly 30,000 adults found that drinking three or more cups of tea per day led to a 69% reduced risk of developing Parkinson's disease.³³

According to research presented at the 2007 Scientific Symposium on Tea and Health, theanine, an amino acid that is for the most part uniquely found in tea (Green and Black), may help prevent age-related memory decline. This human-based data is supported by data from animal models.³⁴

Newer investigations are evaluating the role of EGCG in neurological health. EGCG was found to decrease the expression of inflammatory proteins-tumor necrosis factor α , interleukin 1 β and interleukin 6 and nitric oxide synthase. EGCG was also found to increase levels of intracellular antioxidants, which inhibited reactive oxygen species and had a protective effect on neuronal cells. This evidence suggests that EGCG may be therapeutic option to help attenuate amyloid- β induced neurological decline.³⁶

The role of tea in Alzheimer's disease has also shown positive potential.³⁵ A review authored by Molino, et al., analyzed the neuroprotective effects of tea catechins. The benefit of tea catechins may stem from their antioxidant activity, interaction with cell signaling pathways and anti-inflammatory effects. In addition, the Green tea catechins may be effective in iron chelation which suppresses the translation of amyloid precursor protein and is linked to Alzheimer's disease.³⁷ A recent animal study on the effect of EGCG on the Nrf2 pathway demonstrates that EGCG may have the ability to increase protein clearance to attenuate Alzheimer's Disease progression, especially early on in disease diagnosis.³⁸

Beyond neurocognitive decline, tea has been shown to have several other benefits on the brain. Research has shown that lower contributors of caffeine equal to 1-2 cups of tea daily may benefit cognitive function and sports performance based on adult studies.³⁹ A 2017 review indicates that tea consumption may be related to reduction in anxiety, benefits in memory and attention and brain function.⁴⁰

Factors Related to Diabetes:

In a randomized control trial of 30 subjects, Mahmoud et al found that 3 cups of Black tea consumption resulted in lowered hemoglobin A1C, decreased expression of tumor necrosis factor- α and increased expression of anti-inflammatory cytokines, which may reduce oxidative stress. This suggests Black tea may have a positive effect on long-term diabetes management.⁴¹ In an animal study, obese rats given Green tea polyphenols were found to have lower levels of hyperlipidemia, body fat synthesis, body weight and fat deposits, compared to the control group. Rats given the treatment also had AMPK activation which resulted in greater insulin sensitivity, reduced

de novo lipogenesis and decreased liver fat content.⁴² A recent review found higher habitual intakes of flavan-3-ol monomers, like those found in tea, were associated with a reduction in risk of T2DM (10%) and stroke (18%); and these data were calculated to be of moderate strength.⁴³

Weight Management:

Several studies suggest drinking calorie-free tea may help with weight management.⁴⁴⁻⁵⁶ Preliminary research suggested that tea flavonoids help elevate metabolic rate, increase fat oxidation and improve insulin activity.^{44,47,49,54-57} Tea catechins can also provide modest shifts in metabolism that may improve weight loss and maintenance.^{44,49,55,56} In one review, researchers concluded that subjects consuming Green tea and caffeine lost an average of 2.9 pounds within 12 weeks while adhering to their regular diet. The results of another meta-analysis suggest the increase in caloric expenditure is equal to about 100 calories over a 24-hour period. The weight loss benefits of tea vary based on many factors, but studies have found benefits with the equivalent of as little as 2.5 cups of Green tea.⁵⁷ Using data from the Polish *Health, Alcohol and Psychosocial Factors In Eastern Europe (HAPIEE)* cohort study, tea consumers who drank more than 3 cups daily, had a lower BMI and waist circumference.⁵⁸ A recent analysis also found tea consumption was associated with lower body mass index (BMI) values.⁵⁹

Tea and Bone Health:

A recently published meta-analysis analyzed the potential link between tea consumption and bone mineral density (BMD). Across the studies there was a significant increase in BMD for tea drinkers versus non-drinkers.⁶⁰ A second meta-analysis verified this relationship – 0.62 odds ratio was calculated from 17 studies indicating that higher tea consumption was associated with a lower risk of osteoporosis.⁶¹ A cross-sectional study of Chinese women over the age of 40 from the Guangzhou Nutrition and Health Study found that tea drinking was significantly and independently associated with higher BMD.⁶² Compared to non-tea drinkers, tea drinkers have been found to have a higher BMD.⁶³ Another trial linked tea consumption with a 30 percent reduction in the risk for hip fractures among men and women 50 years of age or older.⁶⁴ Although high caffeine intake has been implicated as a risk factor for reduced bone mineral density (BMD), drinking tea is associated with higher bone mineral density (BMD) and has been shown to boost bone-building markers and improve muscle mass, both of which may reduce the risk for osteoporosis and fracture.⁶⁵⁻⁶⁹

Immune Function:

There has been research on tea's potential impact on immune function. Research from Brigham and Women's Hospital and Harvard University indicated that tea contains a component that can help the body ward off infection and disease and that drinking tea may strengthen the immune system. L-theanine, found in tea, primes the immune system in fighting infection, bacteria, viruses and fungi.⁷⁰ A human clinical trial showed that certain immune cells of participants who drank five cups of black tea a day for two to four weeks secreted up to four times more interferon, an important part of the body's immune defense, than at baseline. The study suggests that drinking black tea provides the body's immune system with natural resistance to microbial infection.⁷⁰ Current research indicates that tea's catechins provide potential preventive effects on influenza and common cold, although more research is needed.⁷¹

Caffeine Content:

Tea is naturally low in caffeine. A cup of Black Tea, for example, contains about 40 milligrams of caffeine.

Cost Per Serving:

Prepared at home, tea costs about three cents per serving, cup or glass. Tea continues to remain one of the most economical beverages available, even the most expensive teas are less than 10 cents per serving.

Tea:

Tea is a refreshing beverage that tastes great and contains no sugar, sodium, or fat. In addition to being naturally calorie-free, it contributes to total water intake promoting hydration.

Key Tea Terms:

Antioxidant: A substance that helps prevent or delay oxidative damage caused by reactive oxygen and or reactive nitrogen species. Oxidative damage to the body, cells and tissues may contribute to diseases like cancer and heart disease.

Phytochemicals: Naturally occurring plant compounds. Many phytochemicals are thought to play a role in decreasing the risk of cancer and heart disease and may boost the immune system. Some phytochemicals such as tea flavonoids are also antioxidants.

Flavonoids: A class of polyphenolic phytochemicals found in tea that are effective antioxidants. Tea flavonoids and related bio-active compounds in tea may play important roles in various areas of health and may operate through a number of different mechanisms still being explored. Tea consumers have

been shown to have approximately 20 times higher flavonoid intake compared with nonconsumers.⁶

Flavonols: A group of flavonoids found in tea and many fruits and vegetables that are antioxidants and are thought to contribute to some of the potential health benefits in these plant foods. They include rutin, quercetin and kaempferol.

Epigallocatechin gallate (EGCG): The principle catechin in Green and Black Teas. EGCG is a strong antioxidant and has been shown to reduce formation of lung, esophageal and skin tumors in animal models of human cancer.

Theanine: An amino acid commonly found in tea that can cross the blood-brain barrier, therefore has psychoactive properties. It may reduce mental and physical stress, and may produce feelings of relaxation by increasing levels of gamma-aminobutyric acid (GABA), serotonin, dopamine, and alpha wave activity.

#

References

1. Larsson SC, Virtamo J, Wolk A. Black tea consumption and risk of stroke in women and men. *Ann Epidemiol*. 2013 Mar;23(3):157-60.
2. Arab L, Liu W, Elashoff D. Green and Black Tea Consumption and Risk of Stroke. A Meta-Analysis. *Stroke*. 2009;40(5):1786-92.
3. Hakim IA, Alsaif MA, Alduwaihy M, Al-Rubeaan K, Al-Nuaim AR, Al-Attas OS. Tea consumption and the prevalence of coronary heart disease in Saudi adults: results from a Saudi national study. *Prev Med*. 2003;36(1):64-70.
4. Geleijnse JM, Launer LJ, Van der Kuip DA, Hofman A, Witteman JC. Inverse association of tea and flavonoid intakes with incident myocardial infarction: the Rotterdam Study. *Am J Clin Nutr*. 2002 May;75(5):880-6.
5. Peters U, Poole C, Arab L. Does tea affect cardiovascular disease? A meta-analysis. *Am J Epidemiol*. 2001;154(6):495-503.
6. Chung M, Zhao N, Wang D, Shams-White M, Karlsen M, Cassidy A, Ferruzzi M, Jacques PF, Johnson EJ, Wallace TC. Dose-Response Relation between Tea Consumption and Risk of Cardiovascular Disease and All-Cause Mortality: A Systematic Review and Meta-Analysis of Population-Based Studies. *Adv Nutr*. 2020 Feb 19. pii: nmaa010. doi: 10.1093/advances/nmaa010. [Epub ahead of print]
7. Miller PE, Zhao D, Frazier-Wood AC, Michos ED, Averill M, Sandford V, Burke GL, et al. Associations of coffee, tea and caffeine intake with coronary artery calcification and cardiovascular events. *Am J Med*. 2016;130 (2): 188-97.

8. Tian C, Huang Q, Yang L, Legare S, Angileri F, Yang H, Li X, et al. Green tea consumption is associated with reduced incident CHD and improved CHD-related biomarkers in the Dongfeng-Tongji cohort. *Sci Rep.* 2016; 6,24353.
9. Li X, Canqing Y, Guo Y, Bian Z, Si J, Yang L, Chen Y et al. Tea consumption and risk of ischaemic heart disease. *Heart.* 2017; 103:783-9.
10. Sesso HD, Gaziano JM, Buring JE, Hennekens CH. Coffee and tea intake and the risk of myocardial infarction. *Am J Epidemiol.* 1999;149:162-7.
11. Kuriyama S, Shimazu T, Ohmori K, Kikuchi N, Nakaya N, Nishino Y, Tsubono Y, Tsuji I. Green tea consumption and mortality due to cardiovascular disease, cancer, and all causes in Japan: the Ohsaki study. *JAMA.* 2006 Sep 13;296(10):1255-65.
12. Davies MJ, Judd JT, Baer DJ, Clevidence BA, Paul DR, Edwards AJ, Wiseman SA, Muesing RA, Chen SC. Black tea consumption reduces total and LDL cholesterol in mildly hypercholesterolemic adults. *J Nutr.* 2003 Oct;133(10):3298S-3302S.
13. Grassi D, Desideri G, Di Giosia P, De Feo M, Fellini E, Cheli P, Ferri L, Ferri C. *Am J Clin Nutr.* 2013 Dec;98(6 Suppl):1660S-1666S. [Epub 2013 Oct 30]. Review.
14. Ling Tao, Jong-Yung Park, Joshua D. Lambert. Differential prooxidative effects of the green tea polyphenol, (-)-epigallocatechin-3-gallate, in normal and oral cancer cells are related to differences in sirtuin 3 signaling. *Mol Nutr Food Res.* 2015 Feb;59 (2):203-11. [Epub 2014 Nov 17].
15. Dora I, Arab L, Martinchik A, Sdvizhkov A, Urbanovich L, Weisgerber U. Black tea consumption and risk of rectal cancer in Moscow population. *Ann Epidemiol.* 2003 Jul; 13(6): 405-11.
16. Su LJ, Arab L. Tea consumption and the reduced risk of colon cancer -- results from a national prospective cohort study. *Public Health Nutr.* 2002 Jun; 5(3): 419-25.
17. Li D, Chen Y, Huang Y, Zhang L, Yang J, Xu X, Liu Q, Zhang X. Study on the anti-tumor ability of niaowangzhong green tea. *J Food Biochem.* 2016 May 21; 41:e12305.
18. Hakim IA, Harris RB. Joint effects of citrus peel use and black tea intake on the risk of squamous cell carcinoma of the skin. *BMC Dermatol.* 2001; 1(1): 3. Epub 2001 Aug 01.
19. Hakim IA, Harris RB, Weisgerber UM. Tea intake and squamous cell carcinoma of the skin: influence of type of tea beverages. *Cancer Epidemiol Biomarkers Prev.* 2000 Jul; 9(7): 727-31.
20. Sharma P, Montes de Oca MK, Alkeswani AR, McClees SF, Das T, Elmets CA, Afaq F. Tea polyphenols for the prevention of UVB-induced skin cancer. *Photodermatol Photoimmunol Photomed.* 2018; 34:50-9.
21. Xinqiang S, Mu X, Lei C, Mun LY. Bioinformatics analysis on molecular mechanism of green tea compound epigallocatechin-3-gallate against ovarian cancer. *Clin Transl Sci.* 2017; 10: 302-7.

22. Rahmani AH, Al Shabrmi FM, Allemailem KS, Aly SM, Khan MA. Implications of green tea and its constituents in the prevention of cancer via the modulation of cell signaling pathway. *BioMed Res Int*. 2015.
23. Moga AM, Dimienescu OG, Arvatescu CA, Mironescu A, Dracea L, Ples L. The role of natural polyphenols in the prevention and treatment of cervical cancer- an overview. *Molecules*. 2016; 21, 1055.
24. Scarmeas N, Luchsinger JA, Schupf N, Brickman AM, Cosentino S, Tang MX, Stern Y. Physical activity, diet, and risk of Alzheimer disease. *JAMA*. 2009 Aug 12; 302:627.
25. Alzheimer's Association. (n.d.) Prevention and Risk of Alzheimer's and Dementia: Heart-Head Connection. Retrieved from http://www.alz.org/research/science/alzheimers_prevention_and_risk.asp#heart
26. Mandel SA, Amit T, Kalfon L, Reznichenko L, Youdim MBH. Targeting multiple neurodegenerative diseases etiologies with multimodal-acting green tea catechins. *J Nutr*. 2008;138:1578S–83S.
27. Egashira N, Ishigami N, et al. Theanine prevents memory impairment induced by repeated cerebral ischemia in rates. *Phytother Res*. 2007 Aug 17; [Epub ahead of print].
28. Rezai-Zadeh K, Shytle D, Sun N, Mori T, Hou H, Jeanniton D, Ehrhart J, Townsend K, Zeng J, Morgan D, Hardy J, Town T, Tan J. Green tea epigallocatechin-3-gallate (EGCG) modulates amyloid precursor protein cleavage and reduces cerebral amyloidosis in Alzheimer transgenic mice. *J Neurosci*. 2005 Sep 21;25(38):8807-14.
29. Kelly SP, Gomez-Ramirez M, Montesi JL, Foxe JJ. L-Theanine and caffeine in combination affect human cognition as evidenced by oscillatory alpha-band activity and attention task performance. *J Nutr*. 2008;138:1572S–7S.
30. Pack S, Jung IC, Lee WK, et al. A Combination of Green Tea Extract and L-Theanine Improves Memory and Attention in Subjects with Mild Cognitive Impairment: A Double-Blind Placebo-Controlled Study. *J Med Food*. 14 (4) 2011, 334–343.
31. De Bruin EA, Rowson MJ, Van Buren L, Rycroft, JA, Owen GN. Black tea improves attention and self-reported alertness. 2011. *Appetite*. 56: 235-240.
32. Tomata Y, Sugiyama K, Jaiho Y, Honkura K, Watanabe T, Zhang S, Sugawara Y, Tsuji I. Green tea consumption and the risk of incident dementia in elderly Japanese: the ohaski cohort 2006 study. *Am J Geriatr Psychiatry*. 2016; 24(10): 881-9.
33. Hu G, Bidel S, et al. Coffee and tea consumption and the risk of Parkinson's disease. *Mov Disord*. 2007 Aug 21: [Epub ahead of print]
34. Egashira N, Ishigami N, et al. Theanine prevents memory impairment induced by repeated cerebral ischemia in rates. *Phytother Res*. 2007 Aug 17; [Epub ahead of print]
35. Rezai-Zadeh K, Shytle D, Sun N, Mori T, Hou H, Jeanniton D, Ehrhart J, Townsend K, Zeng J,

- Morgan D, Hardy J, Town T, Tan J. Green tea epigallocatechin-3-gallate (EGCG) modulates amyloid precursor protein cleavage and reduces cerebral amyloidosis in Alzheimer transgenic mice. *J Neurosci*. 2005 Sep 21;25(38):8807-14.
36. Cheng-Chung Wei J, Huang HC, Chen WJ, Huang CN, Peng CH, Lin CL. Epigallocatechin gallate attenuates amyloid β -induced inflammation and neurotoxicity in EOC 13.31 microglia. *Eur J Pharmacol*. 2016; 770: 16-24.
 37. Molino S, Dossena M, Buonocore D, Ferrari F, Venturini L, Ricevuti G, Verri M. Polyphenols in dementia: from molecular basis to clinical trials. *Life Sci*. 2016; 161: 69-77.
 38. Cheeser AS, Ganeshan V, Yang J, Johnson GVW. Epigallocatechin-3-gallate enhances clearance of phosphorylated tau in primary neurons. *Nutr Neurosci*. 2016; 19(1):21-31.
 39. Ferruzzi MG, Tanprasertsuk J, Kris-Etherton P, Weaver CM, Johnson EJ. Perspective: The Role of Beverages as a Source of Nutrients and Phytonutrients. *Adv Nutr*. 2019 Nov 22. pii: nmz115. doi: 10.1093/advances/nmz115. [Epub ahead of print]
 40. Mancini E, Beglinger C, Drewe J, Zanchi D, Lang Ue, Borgwardt S. Green tea effects on cognition, mood and human brain function: a systematic review. *Phytomedicine* 2017; 34:26-37.
 41. Mahmoud F, Haines D, Al-Ozairi, Dashti, A. Effect of black tea consumption on intracellular cytokines, regulatory T cells and metabolic biomarkers in type 2 diabetes patients. *Phytother Res*. 2016; 30: 454-62.
 42. Rocha A, Bolin AP, Cardoso CA, Otton R. Green tea extract activates AMPK and ameliorates white adipose tissue metabolic dysfunction induced by obesity. *Eur J Nutr*. 2016; 55(7): 2231-44.
 43. Raman, G, Avendano EE, Chen S, Wang J, Matson J, Gayer B, Novotny JA, Cassidy A. Dietary intakes of flavan-3-ols and cardiometabolic health: systematic review and meta-analysis of randomized trials and prospective cohort studies. *Am J Clin Nutr*. 2019 Nov 1;110(5):1067-1078. doi: 10.1093/ajcn/nqz178.
 44. Vernarelli JA, Lambert JD. Tea consumption is inversely associated with weight status and other markers for metabolic syndrome in US adults. *Eur J Nutr*. 2012 Jul 10.
 45. Hursel R, Viechtbauer W, Dulloo AG et al. The effects of catechin rich teas and caffeine on energy expenditure and fat oxidation: a meta-analysis. *Obes Rev*. 2011 Jul;12(7):e573-81.
 46. Hursel R, Viechtbauer W, Westerterp-Plantenga MS. The effects of green tea on weight loss and weight maintenance: a meta-analysis. *Int J Obes (Lond)*. 2009 Sep;33(9):956-61. Epub 2009 Jul 14.
 47. Dulloo AG, Duret C, Rohrer D, Girardier L, Mensi N, Fathi M, Chantre P, Vandermander J. Efficacy of a green tea extract rich in catechin polyphenols and caffeine in increasing 24-h energy expenditure and fat oxidation in humans. *Am J Clin Nutr*. 1999 Dec;70(6):1040-5.

48. Chantre P, Lairon D. Recent findings of green tea extract AR25 (Exolise) and its activity for the treatment of obesity. *Phytomedicine*. 2002;9(1):3-8.
49. Venables MC, Hulston CJ, Cox HR, and Jeukendrup AE. Green tea extract ingestion, fat oxidation, and glucose tolerance in healthy humans. *Am J Clin Nutr*. 2008;87(3):778-84.
50. Nagao T, Hase T and Tokimitsu I. A green tea extract high in catechins reduces body fat and cardiovascular risk in humans. *Obesity*. 2007 Jun;15:1473-83.
51. Nagao T, Komine Y, Soga S, Meguro S, Hase T, Tanaka Y, Yokimitsu I. Ingestion of a tea rich in catechins leads to a reduction in body fat and malondialdehyde-modified LDL in men. *Am J Clin Nutr*. 2005 Jan;81(1):122-9.
52. Tian C, Ye X, Zhang R, Long J et al. Green Tea Polyphenols Reduced Fat Deposits in High Fat-Fed Rats via erk1/2-PPAR γ -Adiponectin Pathway. *PLoS One*. 2013;8(1):e53796.
53. Murase T, Nagasawa A, Suzuki J, Hase T, Tokimitsu I. Beneficial effects of tea catechins on diet-induced obesity: stimulation of lipid catabolism in the liver. *Int J Obes Relat Metab Disord*. 2002;26(11):1459-64.
54. Murase T, Haramizu S, Shimotoyodome A, Tokimitsu I. Reduction of diet-induced obesity by a combination of tea-catechin intake and regular swimming. *Int J Obesity* 2005 Oct:1-8.
55. Shimotoyodome A, Haramizu S, Inaba M, Murase T, Tokimitsu I. Exercise and green tea extract stimulate fat oxidation and prevent obesity in mice. *Med Sci Sports Exerc*. 2005 Nov;37(11):1884-92.
56. Murase T, Haramizu S, Shimotoyodome A, Tokimitsu I, Hase T. Green tea extract improves running endurance in mice by stimulating lipid utilization during exercise. *Am J Physiol Regul Integr Comp Physiol*. 2006 Jun;290(6):R1550-6.
57. Hursel R, Westerterp-Plantenga MS. Catechin- and caffeine-rich teas for control of body weight in humans. *Am J Clin Nutr*. 2013 Dec;98(6 Suppl):1682S-1693S. [Epub 2013 Oct 30].
58. Grosso G, Stepaniak U, Micek A, Topor-Madry R, Pikhart, Szafraniec, Pajak A. Association of daily coffee and tea consumption and metabolic syndrome: results from the Polish arm of the HAPIEE study. *Eur J Nutr*. 2015; 54:1129-37.
59. Vieux F, Maillot M, Rehm CD, Drewnowski A. Tea Consumption Patterns in Relation to Diet Quality among Children and Adults in the United States: Analyses of NHANES 2011-2016 Data. *Nutrients*. 2019 Nov 3;11(11). pii: E2635. doi: 10.3390/nu11112635.
60. Guo M, Qu H, Xu L, Shi D. Tea consumption may decrease the risk of osteoporosis: an updated meta-analysis of observational studies. *Nutr Res*. 2017; 42: 1-10.
61. Sun K, Wang L, Ma Q, Cui Q, Qianru L, BS, Zhang W, Li X. Association between tea consumption and osteoporosis. *Medicine*. 2017; 96:49(e9034).
62. Huang H, Han GY, Jing LP, Chen ZY, Chen YM, SM Xiao. Tea consumption is associated with increased bone strength in middle-aged and elderly Chinese women. *J Nutr Health Aging*. 2018; 22(2): 216-21.

63. Shen CL, Chyu MC, Yeh JK, Zhang Y, Pence BC, Felton CK, Brismee JM, Arjmandi BH, Doctolero S, Wang JS. Effect of green tea and Tai Chi on bone health in postmenopausal osteopenic women: a six-month randomized placebo-controlled trial. *Osteoporos Int*. 2012; 23(5):1541-52.
64. Shen, CL, Chyu, MC, Wang, J. Tea and bone health: steps forward in translational nutrition. *Am J Clin Nutr*. 2013 Dec;98(6 Suppl):1694S-1699S. [Epub 2013 Oct 30].
65. Hegarty VM, May HM, Khaw K-T. Tea drinking and bone mineral density in older women. *Am J Clin Nutr*. 2000;71:1003-7.
66. Wu CH, Yang YC, Yao WJ, Lu FH, Wu JS, Chang CJ. Epidemiological evidence of increased bone mineral density in habitual tea drinkers. *Arch Intern Med*. 2002 May 13;162(9):1001-6.
67. Devine A, Hodgson JM, Dick IM, Prince RL. Tea drinking is associated with benefits on bone density in older women. *Am J Clin Nutr*. 2007;86(4):1243-7.
68. Lloyd T, Rollings NJ, Kieselhorst K, Egli DF, Mauger E. Dietary caffeine intake is not correlated with adolescent bone gain. *J Am Coll Nutr*. 1998;17:454-7.
69. Lloyd T, Johnson-Rollings N, Egli DF, Kieselhorst K, Mauger EA, Cusatis DC. Bone status among postmenopausal women with different habitual caffeine intakes: a longitudinal investigation. *J Am Coll Nutr*. 2000;19:256-61.
70. Kamath AB, Wang L, Das H, Li L, Reinhold VN, Bukowski JF. Antigens in tea-beverage prime human Vgamma 2Vdelta 2 T cells *in vitro* and *in vivo* for memory and nonmemory antibacterial cytokine responses. *Proc Natl Acad Sci USA*. 2003 May 13;100(10):6009-14. Epub 2003 Apr 28.
71. Furushima D, Ide K, Yamada H. Effect of Tea Catechins on Influenza Infection and the Common Cold with a Focus on Epidemiological/Clinical Studies. *Molecules*. 2018 Jul 20;23(7). pii: E1795. doi: 10.3390/molecules23071795.