International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Operating Publisher
SciFormat Publishing Inc.
ISNI: 0000 0005 1449 8214

2734 17 Avenue SW,
Calgary, Alberta, T3E0A7,
Canada
+15878858911
editorial-office@sciformat.ca

ARTICLE TITLE	FROM CAFFEINE TO CATECHINS: A NARRATIVE REVIEW OF THE COMPARATIVE AND SYNERGISTIC EFFECTS OF COFFEE AND MATCHA ON HUMAN HEALTH
DOI	https://doi.org/10.31435/ijitss.2(50).2026.5805
RECEIVED	25 March 2026
ACCEPTED	11 June 2026
PUBLISHED	30 June 2026
LICENSE	The article is licensed under a **Creative Commons Attribution 4.0 International License.**

FROM CAFFEINE TO CATECHINS: A NARRATIVE REVIEW OF THE COMPARATIVE AND SYNERGISTIC EFFECTS OF COFFEE AND MATCHA ON HUMAN HEALTH

Małgorzata Cherek *(Corresponding Author, Email: gosiacherek@icloud.com)*
Szpital św. Wincenta a Paulo, Gdynia, Poland
ORCID ID: 0009-0007-4116-1854

Natalia Marzec
Szpital św. Wojciecha, Gdańsk, Poland
ORCID ID: 0009-0008-4722-7321

Natalia Krupa
Szpital Specjalistyczny w Kościerzynie, Kościerzyna, Poland
ORCID ID: 0009-0007-6691-0073

Natalia Domańska
University Clinical Centre, Gdansk, Poland
ORCID ID: 0009-0008-6378-8903

Dominika Galińska
University Clinical Centre, Gdansk, Poland
ORCID ID: 0009-0004-8037-2679

Anna Roman
Faculty of Medicine, Medical University of Gdansk, Poland
ORCID ID: 0009-0008-7152-9880

Aleksandra Marzec
Szpital św. Wojciecha, Gdańsk, Poland
ORCID ID: 0009-0007-7885-948X

Stanisław Wardęcki
Szpital Morski im. PCK, Gdynia, Poland
ORCID ID: 0009-0008-7703-490X

Joanna Zajączkowska
University Clinical Centre, Gdansk, Poland
ORCID ID: 0009-0003-4912-9809

Weronika Praska
Szpital Morski im. PCK, Gdynia, Poland
ORCID ID: 0009-0004-1544-1404

ABSTRACT

This review compares the effects and benefits of consuming two of the most popular hot beverages: matcha tea and coffee. Both of them have been consumed for centuries and are embedded in cultural, societal, and dietary practices worldwide. They contain various bioactives, including caffeine, L-theanine, and polyphenols, which confer neuroprotective, antioxidant, and stimulating effects. The presence of these compounds has led to increased scientific interest in their potential role in disease prevention and cognitive enhancement.

Matcha is a finely ground powder obtained from green tea leaves (Camellia sinensis) and is traditionally utilized in Japanese tea ceremonies [5]. Its preparation method, which involves consuming the entire leaf, distinguishes it from other tea infusions. It’s rich in catechins, L-theanine, and caffeine, which collectively influence concentration and cognitive performance. Coffee, produced from roasted seeds of the Coffea plant (C. arabica or C. canephora), is high in caffeine and enhances alertness and cognitive function. Due to its widespread consumption, coffee has been extensively studied in both clinical and epidemiological settings

Purpose: This review examines the beneficial effects of hot beverages as reported in studies and by beverage companies. In addition, it aims to provide a comparative perspective that highlights both similarities and differences in their bioactive profiles. While there is abundant research on coffee, studies on matcha tea are limited, underscoring its potential for further investigation.

Methods: A comprehensive literature review was conducted using the electronic databases PubMed and Google Scholar. Search strategies included a combination of keywords related to caffeine, catechins, and cognitive or metabolic outcomes. Relevant articles from the past decade were identified, including meta-analyses, controlled trials, opinion pieces, and review articles. Only studies available in English and focusing on human or relevant animal models were considered.

KEYWORDS

Matcha, Green Tea, Coffee, Caffeine, Catechins, Composition, Health-Promoting Effects

CITATION

Małgorzata Cherek, Natalia Marzec, Natalia Krupa, Natalia Domańska, Dominika Galińska, Anna Roman, Aleksandra Marzec, Stanisław Wardęcki, Joanna Zajączkowska, Weronika Praska. (2026) From Caffeine to Catechins: a Narrative Review of the Comparative and Synergistic Effects of Coffee and Matcha on Human Health. *International Journal of Innovative Technologies in Social Science*. 2(50). doi: 10.31435/ijitss.2(50).2026.5805

1. Introduction

Coffee and matcha are the most popular hot beverages. Their popularity is driven not only by taste preferences but also by perceived functional and health-related benefits. Worldwide, coffee consumption is about 2.3 billion cups per day. This high level of consumption makes coffee one of the most widely studied dietary components globally. In many populations, daily intake among adults ranges from 60% to 90%, with reports of 1 to over 4 cups per day per person depending on geographic region [1]. Such variability reflects differences in cultural habits, availability, and socioeconomic status. In Japan, 50% of consumers report daily intake, while in Western populations, about 12% have replaced at least one daily cup of coffee with matcha, making it increasingly popular, especially among Millennials, where about 40% have tried the beverage [4]. This indicates a developing trend toward alternative caffeinated drinks, which can be perceived as more healthy or natural.

While coffee intake is very well characterized in epidemiological studies, matcha intake is, however, not as properly characterized. This lack of standardized consumption data complicates comparisons between these beverages, limiting direct comparisons.

1.1 How it started - coffee

Ethiopian coffee first arrived on the Arabian Peninsula in 575. Although the exact timeline of early coffee dissemination remains debated, Ethiopia is widely regarded as the origin of Coffea arabica cultivation. At first, coffee beans were chewed to relieve fatigue. In these early uses, coffee was valued primarily for its stimulating properties rather than as a prepared beverage. Historical records indicate that local populations recognised coffee's stimulating effects long before formal brewing techniques were established.

It was only in the fifteenth century that coffee was used as a hot infusion. The transition marked a significant shift in consumption practices, allowing for more widespread and standardised use. The development of brewing techniques in the Arabian Peninsula contributed to the establishment of coffee as a social and cultural beverage. By the end of the sixteenth century, coffee became popular across the Mediterranean Sea, helping to establish the beverage's fame today. Coffeehouses began to emerge in major urban centres, serving as important hubs of social interaction, intellectual exchange, and commercial activity. The spread of coffee throughout Europe further accelerated its integration into daily life and contributed to its global expansion. Over time, coffee evolved from a regional stimulant to one of the most widely consumed beverages worldwide.

1.1.1 Spread of coffee to Poland

Coffee reached Central and Eastern Europe during the late seventeenth century, largely as a result of expanding trade routes and cultural exchange with the Ottoman Empire. One of the most commonly cited historical events associated with the introduction of coffee in Poland is the aftermath of the Battle of Vienna in 1686, during which supplies of coffee left by retreating Ottoman forces contributed to increased awareness and availability of the beverage in the region.

In Poland, coffee was initially regarded as an exotic and unfamiliar product, often met with skepticism before gradually gaining acceptance among the nobility and urban populations. Early adoption was most prominent in larger cities, where coffeehouses began to appear as centers of social and intellectual life, mirroring trends observed in Western Europe. Over time, coffee became integrated into Polish cultural practices, eventually evolving into a widely consumed daily beverage. Today, Poland represents a growing coffee market, with increasing interest in specialty coffee and diverse brewing methods reflecting global consumption trends.

1.2 How it started - matcha tea

Matcha tea history spans over 1,000 years, originating in the Tang Dynasty of China around the seventh to tenth centuries. During this period, tea leaves were often steamed and formed into compressed cakes, which were later ground into powder for consumption. This early form of powdered tea is considered a precursor to what is now known as matcha. The process of infusion was perfected in Japan in the eleventh century. The practice was introduced to Japan by Buddhist monks, who recognised its potential to promote alertness during meditation. Over time, matcha became an integral part of Japanese culture, particularly through the development of formalised tea ceremonies emphasising mindfulness and ritual. The cultivation used in Japan, including shading tea plants before harvest, contributed to the distinctive chemical composition of matcha, particularly its high levels of chlorophyll and amino acids. Matcha became a global phenomenon in the late twentieth century, appearing not only as a beverage but also as an ingredient in foods and dishes. Its expansion beyond Japan was facilitated by globalisation, increased interest in functional foods, and the growing popularity of plant-based diets. In Western countries, matcha gained recognition not only for its unique flavour profile but also for its perceived health benefits. As a result, it has been incorporated into a wide range of products, including desserts, beverages, and nutritional supplements.

1.2.1 Spread of matcha to Poland

Compared to coffee, the introduction of matcha to Poland occurred relatively recently, primarily in the early twenty-first century. Its growing popularity can be linked to global health trends and increased consumer awareness of functional foods rich in antioxidants and bioactive compounds. Matcha initially appeared in specialty tea shops and cafes, where it was marketed as a premium and health-oriented alternative to traditional caffeinated beverages. Over time, its presence expanded into mainstream retail, including supermarkets and online platforms, making it more accessible to a broader population. The rise of social media and wellness culture has also contributed to its popularity, particularly among younger consumers seeking alternatives to coffee. In Poland, matcha is now commonly consumed not only as a traditional tea but also in the form of lattes, desserts, and functional food products. The trend reflects a broader shift toward diversified beverage choices and increased interest in products associated with health and lifestyle benefits.

2. Ways of Infusion

There are several ways to make matcha tea and coffee that can distinguish the amount of caffeine and other biological compounds in a serving, which can differ in the effect on an individual. Preparation methods significantly influence extraction efficiency and the beverage's chemical composition.

2.1 The making of coffee

While there are countless ways to make coffee beverages, hot or cold, this review will focus on 3 popular options that differ in their finished products and caffeine content per serving. These methods represent commonly used preparation techniques used in both domestic and commercial settings.

2.1.1 Espresso

First, a classic espresso made with a coffee machine: for a usual cup of 25-30 ml, about 6,5-7g of freshly ground coffee beans are used. Key factors are the temperature of water, perfectly between 88 and 92˚C, and pressure of about 9 bar. The time it takes for a perfect espresso is around 25-30 seconds of water flow. Due to its high pressure and short extraction time, espresso results in a concentrated beverage with a distinctive flavor profile.

2.1.2 Drip

Making a coffee drip starts with grinding the beans. Those used for drips are usually coarser than espresso grind size. "The shorter the contact time with water, the finer the grounds should be. For longer contact time with water, you'll want coarser grounds," explains Wong. On a scale of 1 to 10, the grind size for drip coffee should be 6.

A recommended coffee-to-bean ratio is around 20 grams of coffee beans per cup and 320 grams of cold and filtered water per cup.

Ground coffee is added to the coffee filter, and water is added to a special compartment, from which it slowly flows over the beans. The temperature of water should be around 92-96˚C. It usually takes 120 to 180 seconds for all the water to drip to a finish. This method allows for greater control over extraction variables such as flow rate and contact time.

2.1.3 Cold brew

The last form of infusions this review will look at is the cold brew. This method of brewing coffee produces a strong concentrate that often needs dilution. As a result, cold brew contains more caffeine per 100 ml than previously mentioned infusions.

Cold brew is a type of iced coffee that takes 12 to 24 hours to finish, making it the longest process this review will look at. This type of infusion requires patience and a lot of coffee grounds. The coffee-to-water ratio is 3 to 4 cups of beans to 4 cups of cold water. The beans need to be very coarsely ground. Both beans and water are then combined in a sealable vessel and stirred vigorously to moisten the grounds. The container is sealed and should stand at room temperature for 12 to 24 hours.

After that time, the infusion should be sieved through a cheesecloth to ensure no beans remain in the liquid. Milk and/or water are added to taste, and the remaining cold brew can be refrigerated for up to 5 days. The extended extraction time at low temperatures yields a different chemical profile than hot brewing methods.

2.2 Matcha

To create a matcha tea infusion, the green tea powder must first be sifted into a small bowl or mug. The powder tends to clump, so it is important to mix it before adding water.

For a serving, usually 3-4 grams of matcha powder are used. After sifting, 10 ml of cold water is added and whisked vigorously, from side to side in an „M" shape. After mixing the paste, 20 ml of hot water at around 60˚C is added, then whisked to introduce air into the mixture. The mixture is finished once a foamy layer appears on top. The prepared mixture can be drunk with milk or more hot water, and various other ingredients, such as fruit puree, can be added to enhance the taste and the experience. Unlike coffee or traditional tea infusions, matcha preparation does not involve filtration, meaning that the entire leaf material is consumed.

2.3 Comparison

The amount of caffeine and the time each infusion takes, along with other information, are shown in Table 1.

Type of infusion	Time of infusion	Grind size	Texture of ground beans	Serving size in mililiters	Caffeine amount per serving
espresso	23-35 seconds	very fine	powdery	30	60-80
drip	2-3 minutes	medium	salt	250	90-150
cold brew	12-24 hours	vey coarse	coarse sea salt	250	100-200
matcha	15-30 seconds	very fine	powdery	100	30-70

3. Chemical Composition of Matcha Tea

Matcha tea contains four main catechins: epicatechin (EC), epicatechin-3-gallate (ECG), epigallocatechin (EGC), and epigallocatechin-3-gallate (EGCG) [3,7,8,9]. These compounds are considered key contributors to the biological activity of green tea-derived products. Polyphenols, such as catechins, make up around 30% of its content [19]. The high polyphenol content is often associated with antioxidant capacity. The most effective of those is EGCG. In studies [14,15,16], its antioxidant, anticancer, antidiabetic, antimicrobial, and neuroprotective roles have been reported. Thanks to those compounds, matcha is considered the highest quality tea. In addition, matcha contains L-theanine, an amino acid that crosses the blood-brain barrier and moderates the neurotransmitter system. The effect of which promotes relaxation and attention, enhancing cognitive functions. Caffeine found in matcha and coffee stimulates the central nervous system by antagonizing adenosine receptors, promoting increased alertness and reduced fatigue. [10]

3.1 Effect of EGCG

In studies [14,15,16], its antioxidant, anticancer, antidiabetic, antimicrobial, and neuroprotective roles have been reported. Research suggests that EGCG prevents neuroinflammation by inhibiting oxidation and preventing pro-oxidative enzymes, indicating a neuroprotective function.

This catechin binds to cell-surface receptors, producing anti-tumor (67-kDa laminin receptor) and anti-inflammatory (toll-like receptor) effects [14,16].

Epigallocatechin gallate, a flavonoid, has been extensively examined in various tutors, including those of the adrenal, bladder, breast, cervical, colorectal, esophageal, gastric, liver, lung, oral, ovarian, pancreatic, prostate, and skin. Its anti-tumor effects have been documented, demonstrating inhibition of cell proliferation, migration, adhesion, invasion, and metastasis. Research indicates that it can activate cascades and enzymes that initiate and execute apoptosis.

Potential hallmarks targeted by EGCG are shown in Table 2 [15].

1. Genome instability
2. Resisting cell death
3. Tumorigenesis and carcinogen activity
4. Sustained proliferative signalling
5. Evading growth suppressors
6. Enabling replicative immortality
7. Deregulating cellar metabolism
8. Tumor-promoting inflammation
9. Inducing angiogenesis
10. Tissue invasion and Metastasis
11. Immune Evasion

Supplementation with EGCG has been observed to mitigate inflammatory complications following cardiopulmonary bypass. It significantly decreases lipid peroxidation and increases antioxidant levels.

In animal studies, a 60-day intragastric administration of EGCG prevented cognitive decline in mice and reduced the buildup of beta-amyloid, a crucial feature of Alzheimer’s disease [16]. These mechanisms suggest that EGCG may modulate multiple cellular pathways simultaneously.

3.2 Effect of L-theanine

A non-protein amino acid found in mushrooms and tea that modulates stress, sleep, and mood. Its structure is similar to that of glutamate, which helps reduce glutamate excitotoxicity [14,17] and fosters neurogenesis. Animal studies show improved behavior under stressful situations and enhanced learning under socially stressful conditions [17]. In human studies, theanine was associated with improved cognitive function, including attention and reaction time in a cognitive task [17, 33]. Research indicates that L-theanine can increase gamma-aminobutyric acid (GABA) levels, thereby promoting relaxation [18]. It has been observed to diminish tension and anxiety. Studies have documented its capacity to decrease levels of adrenocorticotropic hormone and corticosterone in the hippocampus and prefrontal cortex [31]. Additionally, it has been shown to suppress adrenal hypertrophy and neuroinflammation in mice [14]. Its interaction with neurotransmitter systems distinguished it from other dietary amino acids. The findings from these studies suggest that it is beneficial for sleep quality and has a positive impact on depression and anxiety.

3.3 Effect of Phenolic Acids

Characterized as antioxidants and with anti-inflammatory potential, phenolic acids are secondary plant metabolites. They have been reported to prevent metastasis and inhibit cancer cell growth, warranting further investigation [25].

They lower total cholesterol, LDL levels, and the plaque-to-lumen ratio, thereby reducing atherosclerosis by improving the gut microbiome [16].

3.4 Effect of Chlorophyll

Matcha is characterised by a relatively high chlorophyll content compared to other green teas, largely due to the shading of tea before harvest [3, 10]. This cultivation method enhances chlorophyll synthesis, giving matcha its distinctive bright green colour and contributing to its overall chemical profile [3].

Chlorophyll has been associated with antioxidant activity and may play a role in reducing oxidative stress, although its specific effects on humans require further investigation [3]. In addition, chlorophyll has been suggested to support detoxification processes by binding compounds in the digestive tract, potentially influencing their absorption [3]. While the contribution of chlorophyll to the overall health effects of matcha is less extensively studied than that of catechins, it is considered an important component of its bioactive composition [3, 10].

3.5 Conclusion

Matcha tea has significant potential due to its bioactive compounds. Contains higher concentrations of phenolic acids, thiamine, and chlorophyll than standard green tea.

The effects of the matcha compounds are presented in Table 3.

The effect on health	The compound	The mechanism
	EGCG	inhibit tutor angiogenesis, suppress inflammation [9, 15, 26]
Anticarcinogenic	Catechins	inhibit tutor growth factors, induce apoptosis [26]
	Phenolic Acids	inhibit cancer cell growth, prevent metastasis [25]
Anti-inflammatory	EGCG	regulation of inflammatory response [27]
Cardioprotective	EGCG	reduce oxidative stress [28], minimises platelet aggregation and vascular remodelling [16]
Cognitive function	EGCG	inhibit production of ROS, decreases production of beta amyloid [29, 30]
	Caffeine	reverse oxidative processes, reduces neuroinflammation [31]
Mental disorders	L-theanine	alleviates psychiatric symptoms, increased serotonin, norepinephrine and dopamine levels [18]

These effects demonstrate the promising benefits of matcha tea and its constituents. Making it a prime example to support further research, as current evidence is limited, and matcha has only recently gained popularity outside Japan. It is essential to understand the effects and the potential advantages of regular matcha tea consumption.

4. Chemical Composition of Coffee

The main active constituent in coffee is previously mentioned caffeine, a methylxanthine alkaloid and adenosine receptor antagonist. Affecting reduced inhibitory neurotransmission, which promotes alertness, reduces fatigue, and improves cognitive function. Furthermore, caffeine stimulates catecholamine release, increasing heart rate, blood pressure, and metabolic rate.

Another bioactive compound found in coffee is chlorogenic acid (CGA), a polyphenol with antioxidant properties.

4.1 Effects of caffeine

Caffeine is included in the xanthine group, a class of adenosine receptor antagonists, mainly A1 and A2A [20,21]. Blocking the A1 and A2A receptors facilitates the release of neurotransmitters and modulates systems of GABA, glutamate, dopamine, and serotonin [22,23]. Various studies show that caffeine improves mood, reaction time, and vigilance when alertness is reduced [22] and helps reduce fatigue and overall exhaustion.

Reaction time improves with doses of 12.5 to 400 mg in both rested and sleep-deprived subjects. Coffee improves performance when vigilance and attention are required [22, 34]. Studies on short-term memory have given mixed results, making it a subject in need of further investigation [22].

In summary, caffeine can enhance alertness regardless of whether the individual is well-rested or sleep-deprived, and these effects are dose-dependent. The most reliable benefit of caffeine is its effect on vigilance, which is evident in both rested and fatigued individuals. The extent of these effects varies depending on individual sensitivity and habitual caffeine intake.

4.2 Caffeine and sleep

Research by Gardiner et al. has shown that a dose of 100 mg of caffeine can be consumed up to 4 hours before going to sleep; however, a dose of 400 mg has a negative impact even when consumed within 12 hours before bedtime [24]. These findings demonstrate that both the dose and timing of caffeine intake are critical determinants of its impact on sleep quality [24]. Caffeine exerts its effects primarily by antagonizing adenosine receptors, which play a key role in promoting sleep and regulating the sleep-wake cycle [20, 21]. By blocking adenosine signaling, coffee reduces sleep pressure, thereby delaying sleep onset and decreasing subjective feelings of sleepiness [20,22]. In addition to increasing sleep latency, caffeine consumption has been associated with reductions in total sleep time and alterations in sleep architecture [22,24]. Habitual caffeine consumers may develop partial tolerance to some of its stimulating effects, and sleep disturbances may reveal significant changes in sleep quality. Importantly, even when individuals do not perceive sleep disruptions, objective measures may reveal significant changes in sleep quality [22, 24].

When comparing coffee and matcha, differences in caffeine delivery and accompanying compounds may influence their respective effect on sleep. Coffee typically provides a rapid increase in plasma caffeine levels, which may contribute to a more pronounced acute stimulation [22]. In contrast, matcha contains L-theanine, which has been suggested to promote relaxation and may partially counteract the stimulatory effects of caffeine [14,18]. This interaction could result in a more gradual onset of alertness and potentially a reduced impact on sleep latency, although direct comparative studies are lacking [14, 17]. These findings highlight the importance of timing when consuming caffeinated beverages. From a practical perspective, limiting caffeine intake in the hours preceding sleep is generally recommended to minimize sleep disturbances [24]. Current evidence suggests that avoiding caffeine for several hours before bedtime may be beneficial, although individual variability should be considered [24]. Additionally, total daily caffeine intake should be monitored, as cumulative effects may also influence sleep quality [22].

Overall, while caffeine offers well-documented cognitive and performance benefits, its impact on sleep represents an important factor in evaluating the cumulative health effects of both coffee ant matcha consumption [22, 24].

5. Caffeine Content

Matcha has a relatively high caffeine content compared to other green teas, ranging from 18.9 to 44.4 mg/g. [10] For the sake of comparison, a classic green tea contains around 11.3-24.67 mg/g [11]. Caffeine content depends on the tea variety and brewing method [10].

Coffee contains about 10-27 mg/g of caffeine, making for a range of 12.8 to 309.4 mg per serving, depending on the type and size of the beverage [13]. Variability in caffeine content is strongly influenced by preparation methods and serving size.

The caffeine content in popular drinks and beverages is shown in Table 4. [22]

Drink/beverage	Serving size in ml	Caffeine content mg per serving
Coffee		
espresso	60	32.5-75
cappuccino	200	52-89
decaffeinated	150	2-5
Tea		
black tea	250	40-70
green tea	250	30-50
Matcha tea	150	28-66
Coca Cola	350	35
Red Bull	235	80

6. Discussion

Multiple positive effects have been found through this narrative review. These effects are largely attributed to bioactive compounds that modulate neurological, metabolic, and inflammatory pathways [3,14,22]. These findings are consistent with a growing body of literature supporting health-promoting properties of bioactive compounds in the mentioned beverages. However, what was found is that while there is considerable research on coffee and caffeine, that on matcha and its biological contents remains limited. This discrepancy in research volume is likely due to the long-standing global prevalence of coffee consumption compared to the relatively recent rise in matcha popularity outside of East Asia [1, 2]. This imbalance in the evidence underscores the need for more controlled studies focused specifically on matcha and highlights the importance of ongoing research to better understand its effects and benefits, as well as those of its constituents. Given the information available at the time this review was created, coffee and matcha have been found to have a positive impact on mental impairment, fatigue, and tasks that require vigilance. These shared effects are primarily mediated by caffeine, which acts as a central nervous system stimulant in both beverages [20, 22]. Despite this similarity, the presence of additional compounds in matcha, such as L-theanine, may modulate the physiological response to caffeine, producing a more sustained and less abrupt stimulatory effect [14, 18]. Numerous articles and studies point to a positive impact on possible cancer treatment and prevention, cardiac health, and inflammation. These findings suggest that both beverages contribute to disease prevention through overlapping but distinct biochemical pathways [15, 16, 25].

6.1 Comparison

When comparing coffee and matcha directly, several important distinctions emerge in terms of their chemical composition and physiological effects. Coffee is characterized by a relatively high concentration of caffeine and chlorogenic acids, which have been associated with metabolic and cardiovascular effects [13]. In contrast, matcha provides a broader spectrum of polyphenols, particularly catechins such as EGCG, which are linked to antioxidant and anti-inflammatory properties [3, 9, 16]. These compositional differences may result in variations in both the intensity and duration of their biological effects [3, 22].

6.2 Cognitive and neurological effects

Both drinks are linked to better cognitive performance, especially in attention, vigilance, and reaction speed [22]. However, matcha's blend of caffeine and L-theanine is thought to create a synergistic effect that boosts focus while minimizing jitteriness [14, 17]. This interaction may explain why some individuals report smoother, more sustained cognitive enhancement after consuming matcha than after coffee [14, 18].

In contrast, the rapid absorption of caffeine from coffee may lead to a more immediate but shorter-lived increase in alertness [22].

6.3 Cardiometabolic and anti-inflammatory effects

Both coffee and matcha have been investigated for their potential roles in cardiovascular health [16, 25]. Coffee consumption has been associated with improvement in metabolic rate and potential reductions in the risk of certain chronic diseases, although results remain variable across populations [13,22]. Matcha, due to its high catechin content, may exert additional protective effects through antioxidant mechanisms and modulation of lipid metabolism[2, 16]. Furthermore, the anti-inflammatory effects observed in both beverages may contribute to their overall health benefits [8,1 6].

6.4 Limitations of current evidence

Despite promising findings, several limitations should be acknowledged while interpreting the available data. Many studies differ in methodology, including variations of dosage, preparation methods, and participant characteristics [22]. Additionally, observational studies on coffee consumption may be influenced by confounding lifestyle factors, such as diet, physical activity, and smoking status [1, 22]. For matcha, the limited number of human studies restricts the ability to draw definitive conclusions regarding long-term health outcomes [14, 17].

Future research should aim to directly compare the effects of coffee and matcha in controlled experimental settings. Standardization of preparation methods and dosage would improve the reliability and comparability of results [6]. Moreover, studies investigating the synergistic interactions between caffeine and other bioactive compounds, particularly catechins and L-theanine, would provide valuable insights [14, 18]. Longitudinal studies are also necessary to evaluate the long-term health effects of regular consumption of these beverages [3, 22].

6.5 Conclusions

In summary, both coffee and matcha appear to offer beneficial effects on cognitive function and overall health, although their mechanisms of action differ [3, 22]. Coffee provides a well-established source of caffeine with immediate stimulatory effects, while matcha offers a more complex profile of bioactive compounds that may result in broader and more sustained physiological benefits [3, 14]. The choice between these beverages may therefore depend on individual preferences, tolerance to caffeine, desired functional outcomes, and taste.

REFERENCES

1. IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. (1991). Coffee. In *Coffee, tea, mate, methylxanthines and methylglyoxal* (IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol. 51). International Agency for Research on Cancer.
2. Hu, H., Zhang, H., Liu, Z., Liu, Z., Yang, C., & Wang, J. (2026). From coffee to matcha: Decoding the multidimensional competence of matcha as a sustainable and health-promoting coffee substitute. *Journal of the Science of Food and Agriculture*. Advance online publication. https://doi.org/10.1002/jsfa.70492
3. Kochman, J., Jakubczyk, K., Antoniewicz, J., Mruk, H., & Janda, K. (2020). Health benefits and chemical composition of matcha green tea: A review. *Molecules, 26*(1), Article 85. https://doi.org/10.3390/molecules26010085
4. Patel, S. (n.d.). *Tea statistics*. World Metrics.
5. Horie, H., Ema, K., & Sumikawa, O. (2017). Chemical components of matcha and powdered green tea. *Journal of Cookery Science of Japan, 50*, 182–188.
6. Kurleto, K., Kurowski, G., Laskowska, B., Malinowska, M., Sikora, E., & Vogt, O. (2013). Wpływ warunków parzenia na zawartość antyoksydantów w naparach różnych rodzajów herbat. *Wiadomości Chemiczne, 67*, 11–12.
7. Pastoriza, S., Mesías, M., Cabrera, C., & Rufián-Henares, J. A. (2017). Healthy properties of green and white teas: An update. *Food & Function, 8*, 2650–2662. https://doi.org/10.1039/C7FO00611J
8. Ohishi, T., Goto, S., Monira, P., Isemura, M., & Nakamura, Y. (2016). Anti-inflammatory action of green tea. *Anti-Inflammatory & Anti-Allergy Agents in Medicinal Chemistry, 15*, 74–90. https://doi.org/10.2174/1871523015666160915154443
9. Du, G.-J., Zhang, Z., Wen, X.-D., Yu, C., Calway, T., Yuan, C.-S., & Wang, C.-Z. (2012). Epigallocatechin gallate (EGCG) is the most effective cancer chemopreventive polyphenol in green tea. *Nutrients, 4*, 1679–1691. https://doi.org/10.3390/nu4111679
10. Koláčková, T., Kolofiková, K., Sytařová, I., Snopek, L., Sumczynski, D., & Orsavová, J. (2020). Matcha tea: Analysis of nutritional composition, phenolics, and antioxidant activity. *Plant Foods for Human Nutrition, 75*, 48–53. https://doi.org/10.1007/s11130-019-00777-z
11. Čížková, H., Voldřich, M., Mlejnecká, J., & Kvasnička, F. (2008). Authenticity evaluation of tea-based products. *Czech Journal of Food Sciences, 26*, 259–267. https://doi.org/10.17221/10/2008-CJFS
12. Fox, G. P., Wu, A., Yiran, L., & Force, L. (2013). Variation in caffeine concentration in single coffee beans. *Journal of Agricultural and Food Chemistry, 61*(45), 10772–10778. https://doi.org/10.1021/jf4011388
13. Wierzejska, R. E., & Gielecińska, I. (2024). Evaluation of the caffeine content in servings of popular coffees in terms of its safe intake—Can we drink 3–5 cups of coffee per day, as experts advise? *Nutrients, 16*(15), Article 2385. https://doi.org/10.3390/nu16152385
14. Cavanah, A. M., Robinson, L. A., Mattingly, M. L., & Frugé, A. D. (2025). The impact of green tea and its bioactive compounds on mood disorder symptomology and brain-derived neurotrophic factor: A systematic review of randomized controlled trials. *Biomedicines, 13*(7), Article 1656. https://doi.org/10.3390/biomedicines13071656
15. Talib, W. H., Awajan, D., Alqudah, A., Alsawwaf, R., Althunibat, R., Abu AlRoos, M., Al Safadi, A., Abu Asab, S., Hadi, R. W., & Al Kury, L. T. (2024). Targeting cancer hallmarks with epigallocatechin gallate (EGCG): Mechanistic basis and therapeutic targets. *Molecules, 29*, Article 1373. https://doi.org/10.3390/molecules29061373
16. Mokra, D., Joskova, M., & Mokry, J. (2022). Therapeutic effects of green tea polyphenol (−)-epigallocatechin-3-gallate (EGCG) in relation to molecular pathways controlling inflammation, oxidative stress, and apoptosis. *International Journal of Molecular Sciences, 24*, Article 340. https://doi.org/10.3390/ijms24010340
17. Baba, Y., Inagaki, S., Nakagawa, S., Kobayashi, M., Kaneko, T., & Takihara, T. (2021). Effects of daily matcha and caffeine intake on mild acute psychological stress-related cognitive function in middle-aged and older adults: A randomized placebo-controlled study. *Nutrients, 13*, Article 1700. https://doi.org/10.3390/nu13051700
18. Moshfeghinia, R., Sanaei, E., Mostafavi, S., Assadian, K., Sanaei, A., & Ayano, G. (2024). The effects of L-theanine supplementation on the outcomes of patients with mental disorders: A systematic review. *BMC Psychiatry, 24*, Article 886. https://doi.org/10.1186/s12888-024-06285-y
19. Rovaldi, E., Di Donato, V., Paolino, G., Bruno, M., Medei, A., Nisticò, S. P., Pellacani, G., Kiss, N., Azzella, G., Banvolgyi, A., & Cantisani, C. (2025). Epigallocatechin-gallate (EGCG): An essential molecule for human health and well-being. *International Journal of Molecular Sciences, 26*(18), Article 9253. https://doi.org/10.3390/ijms26189253
20. da Silva Neves, L., de Mattos, G. V. R. M., Oliveira-Nazareth, Y., da Silva, R. S., & Campello-Costa, P. (2025). Effects of caffeine on neuroinflammation in anxiety and depression: A systematic review of rodent studies. *Translational Psychiatry, 15*(1), Article 477. https://doi.org/10.1038/s41398-025-03668-x
21. Fredholm, B. B., Battig, K., Holmén, J., Nehlig, A., & Zvartau, E. E. (1999). Actions of caffeine in the brain with special reference to factors that contribute to its widespread use. *Pharmacological Reviews, 51*, 83–133.

22. McLellan, T. M., Caldwell, J. A., & Lieberman, H. R. (2016). A review of caffeine's effects on cognitive, physical, and occupational performance. *Neuroscience & Biobehavioral Reviews, 71*, 294–312. https://doi.org/10.1016/j.neubiorev.2016.09.001
23. Alasmari, F. (2020). Caffeine induces neurobehavioral effects through modulating neurotransmitters. *Saudi Pharmaceutical Journal, 28*, 445–451. https://doi.org/10.1016/j.jsps.2020.02.005
24. Gardiner, C. L., Weakley, J., Burke, L. M., Fernandez, F., Johnston, R. D., Leota, J., Russell, S., Munteanu, G., Townshend, A., & Halson, S. L. (2025). Dose and timing effects of caffeine on subsequent sleep: A randomized clinical crossover trial. *Sleep, 48*(4), Article zsae230. https://doi.org/10.1093/sleep/zsae230
25. Weng, C.-J., & Yen, G.-C. (2012). Chemopreventive effects of dietary phytochemicals against cancer invasion and metastasis: Phenolic acids, monophenol, polyphenol, and their derivatives. *Cancer Treatment Reviews, 38*, 76–87. https://doi.org/10.1016/j.ctrv.2011.03.001
26. Shimizu, M., Fukutomi, Y., Ninomiya, M., Nagura, K., Kato, T., Araki, H., Suganuma, M., Fujiki, H., & Moriwaki, H. (2008). Green tea extracts for the prevention of metachronous colorectal adenomas: A pilot study. *Cancer Epidemiology, Biomarkers & Prevention, 17*, 3020–3025. https://doi.org/10.1158/1055-9965.EPI-08-0528
27. Ohishi, T., Goto, S., Monira, P., Isemura, M., & Nakamura, Y. (2016). Anti-inflammatory action of green tea. *Anti-Inflammatory & Anti-Allergy Agents in Medicinal Chemistry, 15*, 74–90. https://doi.org/10.2174/1871523015666160915154443
28. Kim, S. J., Li, M., Jeong, C. W., Bae, H. B., Kwak, S. H., Lee, S. H., Lee, H. J., Heo, B. H., Yook, K. B., & Yoo, K. Y. (2014). Epigallocatechin-3-gallate, a green tea catechin, protects the heart against regional ischemia–reperfusion injuries through activation of RISK survival pathways in rats. *Archives of Pharmacal Research, 37*, 1079–1085. https://doi.org/10.1007/s12272-013-0309-x
29. Kim, J., Funayama, S., Izuo, N., & Shimizu, T. (2019). Dietary supplementation of a high-temperature-processed green tea extract attenuates cognitive impairment in PS2 and Tg2576 mice. *Bioscience, Biotechnology, and Biochemistry, 83*, 2364–2371. https://doi.org/10.1080/09168451.2019.1659721
30. Liu, J.-B., Zhou, L., Wang, Y.-Z., Wang, X., Zhou, Y., Ho, W.-Z., & Li, J.-L. (2016). Neuroprotective activity of (−)-epigallocatechin gallate against lipopolysaccharide-mediated cytotoxicity. *Journal of Immunology Research, 2016*, Article 4962351. https://doi.org/10.1155/2016/4962351
31. Ritchie, K., Carrière, I., de Mendonça, A., Portet, F., Dartigues, J.-F., Rouaud, O., Barberger-Gateau, P., & Ancelin, M.-L. (2007). The neuroprotective effects of caffeine: A prospective population study (the Three City Study). *Neurology, 69*, 536–545. https://doi.org/10.1212/01.wnl.0000266670.35219.0c
32. Peng, B., Liu, Z., Lin, Y., Lin, H., & Huang, J. A. (2014). The ameliorative effect of L-theanine on chronic unpredictable mild stress-induced depression in rats. *Journal of Tea Science, 34*, 355–363.
33. Dietz, C., Dekker, M., & Piqueras-Fiszman, B. (2017). An intervention study on the effect of matcha tea, in drink and snack bar formats, on mood and cognitive performance. *Food Research International, 99*, 72–83. https://doi.org/10.1016/j.foodres.2017.05.002
34. Lieberman, H. R., Carvey, C. E., & Thompson, L. A. (2010). Caffeine. In P. M. Coates (Ed.), *Encyclopedia of dietary supplements*. Informa Healthcare USA.