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## **THE ADVANTAGE OF MATCHA GREEN TEA OVER OTHER DRINKS: A COMPREHENSIVE REVIEW**

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**Abstract**

Matcha green tea is a finely ground powder made from specially cultivated and processed leaves of *Camellia sinensis*. Key components of matcha include catechins, caffeine, theanine, fat-soluble vitamins, insoluble dietary fibers, chlorophylls, and proteins. Studies indicate that matcha green tea may offer various health benefits, such as reducing the effects of aging, alleviating stress, and mitigating cognitive impairment. Furthermore, regular consumption of matcha tea supports gut microbiome health, enhances immune function, and reduces the risk of inflammation as well as certain types of cancer. This review strengthens the connection between regular intake of matcha green tea and overall well-being.

**Methods**

A systematic literature search was conducted using PubMed and Google Scholar data bases, focusing on studies published in English and Polish that examined the healthy benefits of

drinking matcha green tea and advantages over other drinks that increase energy level. Keywords included "matcha" "energy level" "obesity" "antioxidant".

### **Aim of the study:**

The aim of our work is to review and summarize the most interesting conclusions from the research on the impact of matcha green tea on energy level and fatigue as well as other health aspects.

### **Keywords**

Matcha, Caffeine , Cognitive function, Green tea, Fatigue, Gut microbiota, Antioxidants

### **Introduction**

Matcha green tea, a finely ground powder made from specially cultivated and processed *Camellia sinensis* leaves, has recently garnered significant attention for its potential health benefits[1]. Unlike traditional green tea, matcha is grown under shaded conditions, which enhances the production of bioactive compounds such as catechins, particularly the most active(-)- epigallocatechin-3-gallate (EGCG) from among others: (-)-epicatechin (EC), (-)-epicatechin-3-gallate (ECG), (-)-epigallocatechin (EGC)[2][3][4][5]. These unique growing and processing methods result in a product that is notably richer in antioxidants and other beneficial components, making matcha a subject of growing scientific interest.

### **Matcha tradition**

The origins of matcha tea ceremonies are often traced to Zen Buddhist monks, who introduced the practice of preparing and consuming powdered green tea to Japan. The use of matcha was initially intertwined with Zen Buddhism, where monks consumed it to aid meditation, promoting mental clarity and alertness[7][8]. In recent years, it has been embraced globally as an ingredient in a variety of foods, due to its vibrant green color, distinctive flavor, and, most importantly, its health-promoting properties[9]. Emerging evidence suggests that matcha may play a role in reducing the risk of several chronic diseases, including cardiovascular disease, cancer, neurodegenerative disorders and supporting the cognitive system, due to its potent antioxidant and anti-inflammatory effects[10].

### **Extraction of biologically active compounds**

Matcha contains many other valuable ingredients like L-theanine, caffeine and chlorophyll, characterized by high antioxidant potential, that are believed to contribute a lot of health benefits. In addition, matcha is rich in vitamin C, rutin and quercetin[1][2][6]. Extracting these ingredients requires a sufficiently high temperature[2][20]. A study by Komes et al. compared various forms of green tea, including bagged, loose leaf, and powdered matcha, and found that the antioxidant capacity of green tea increases with higher water temperatures and shorter brewing times[11]. The powdered form of matcha consistently showed the highest antioxidant capacity across different brewing conditions, with optimal results at higher temperatures. The high antioxidant potential of matcha is enhanced by its powdered form, resulting from a unique grinding process that accelerates the extraction of polyphenolic compounds[2][20]. Research by Fujioka et al. demonstrates that powdered matcha contains a

higher polyphenol content compared to traditional tea leaf infusions[12]. Similarly, Shishikura and Khokhar found that matcha, prepared as a powder, is more effective at extracting these compounds in a shorter time[13].

### **Advantages of matcha over other energy drinks**

Matcha green tea, coffee and energy drinks each provide distinct energy-boosting effects due to their unique compositions of caffeine, antioxidants and additional compounds. Matcha seems to have an advantage over other drinks in a long-lasting effect. In the study conducted by Yoshitake Baba, Shun Inagaki, Sae Nakagawa, Makoto Kobayashi, Toshiyuki Kaneko, and Takanobu Takihara, the effects of matcha and caffeine consumption on cognitive functions were examined in a group of middle-aged and older adults, focusing specifically on mild acute psychological stress induced by the Uchida–Kraepelin test. Published in 2021, the article compares the effects of both single and continuous administration of matcha and caffeine to determine their impact on memory, attention, facial expression recognition, working memory, visual information processing, motor functions, and the ability to perform tasks requiring focus under stress[14]. Matcha did not show as pronounced a reaction time reduction as caffeine but improved performance in the UKT after 12 weeks of continuous consumption. This suggests that matcha may be beneficial for maintaining focus during prolonged, simple computational tasks, especially under stress[14][15][34]. Differences in the effects of caffeine and matcha may stem from the presence of other bioactive compounds in matcha, such as theanine and catechins[16][17]. Matcha with an appropriate component ratio, specifically with a low amount of caffeine and EGCG compared to theanine and arginine, has anti-stress effects[17][18]. The molar ratio of caffeine and epigallocatechin gallate (CE) to theanine and arginine (TA)- CE/TA is important. Studies on rodents and humans have shown that matcha with a CE/TA ratio of 2 or lower effectively reduces stress, while matcha with a higher ratio does not exhibit this effect[18]. It seems that theanine regulates the effects of caffeine[19].

### **Health benefits**

#### **Impact on human microbiota, liver and blood glucose level**

Recently, there has been a growing interest in Japanese green tea known as matcha and its diverse effects on health. Scientific studies indicate numerous benefits associated with regular consumption of matcha, not only in the form of a beverage.

#### **Human microbiota**

The human microbiota is defined as a collection of organisms that inhabit and interact with the human body. These interactions can be commensalistic, mutualistic, or pathogenic. The human microbiome refers to the genomic content of these organisms residing in specific sites within the body. Such interactions are crucial for maintaining overall health and well-being[26]. Dysbiotic gut microbiotas are usually associated with gastrointestinal diseases such as the irritable bowel syndrome and the inflammatory bowel disease (IBD) as well as with various systemic disorders such as diabetes and autism[22]. The gut barrier is a complex and dynamic collection of physical and chemical structures that surveil the environment and protects the host from microbial invaders and harmful stimuli[27]. Gut microbiota has been

characterized to have related underlying mechanisms in obesity for it plays a key role in energy homeostasis, immunity and blood circulation[21]. There is growing evidence that the gut microbiome-liver axis plays a role in NAFLD[27].

Research conducted in Japan in 2022 has shown that matcha green tea consumption for two weeks affected the fecal microbiota leading to an increase of beneficial *Coprococcus* and a decrease of potential pathogenic *Fusobacterium* in the gut microbiota. This suggests that long-term consumption of matcha could be beneficial for the host's health[22]. Additionally, another studies have showed improvement in biochemical parameters, the diversity and compositions of key flora as well as the proportion of fecal BAs levels which illustrate that the related gut–liver axis is the potential regulatory target of matcha in improving lipid accumulation and metabolic disorders[21]. However there are still not entirely and properly studied its interactions with intestinal microflora and impact on infectious diseases, therefore it requires further study.

### **Obesity**

Obesity is a complex multifactorial disease that accumulated excess body fat leads to negative effects on health[28]. Obesity results in a state of chronic inflammation, abnormal hormonal and immune system responses and ultimately systemic metabolic dysregulation. The etiology of obesity is multifactorial with genetics, environmental factors, socioeconomic status and behavioural factors all contributing to the development and persistence of obesity[29]. Some of the co-morbidities related to overweight and obesity include cancers (cancers of breast, endometrial, ovarian, colorectal, esophageal, kidney, pancreatic, prostate), Type 2 diabetes, hypertension, stroke, Coronary Artery Disease, Congestive Heart Failure, asthma, chronic back pain, osteoarthritis, pulmonary embolism, gallbladder disease and also an increased risk of disability[30]. Several countries worldwide have witnessed a double or triple escalation in the prevalence of obesity in the last three decades, probably due to urbanization, sedentary lifestyle and increase consumption of high-calorie processed food[31]. NAFLD (Non-alcoholic fatty liver disease) is currently the most common chronic liver disease in the Western world and is considered a prototypic metabolic disorder at the interface of obesity[30]. Studies showed that the low to moderate levels (0.025–0.05%) of matcha consumption in a high-fat diet successfully prevented weight gain to levels significantly different from mice on a control diet. Moderate to high levels of matcha however (0.05%–0.075%) resulted in a statistically significant reduction of total cholesterol, triglycerides, and LDL levels, as well as an increase in HDL levels[10]. A similarly significant, but less intense, reduction in blood glucose levels was also reported with all levels of matcha consumption[21][10]. Green tea contains four main catechins, one of them (–)epigallocatechin-3-gallate (EGCG) by improving tissue sensitivity to insulin and leptin and reducing blood lipid parameters, may inhibit obesity-related carcinogenesis[4].

### **Impact on cognitive function**

Consumption of green tea is regarded as an effective dietary intervention to promote clarity of mind and cognitive function. These health benefits are attributed mainly to epigallocatechin

gallate (EGCG)[2]. Bioactive compounds abundant in matcha such as caffeine, theanine and catechins have been linked to multiple benefits to the cognitive function[10]. Another studies suggest that matcha and decaffeinated matcha could reduce aging and cognitive impairment by regulating the expression of particular proteins[23]. Additionally, studies done in 2020 suggest that daily supplementation of matcha green tea powder may have a beneficial effect against cognitive decline in clinically normal elderly women[24].

### **Impact on Mental Health**

Studies have demonstrated beneficial aspects of matcha concerning mental health, particularly its stress-reducing effects. Research conducted in Japan in 2019 indicated that daily intake of matcha with a low catechin-to-tannin (CE/TA) molar ratio in confectioneries may provide a simple and practical means of preventing stress accumulation[18]. Furthermore, studies from 2020 concluded that theanine, the primary amino acid found in tea leaves, can suppress brain atrophy. It is suggested that theanine helps prevent stress-induced brain atrophy by modifying early stress responses. These findings highlight the potential of matcha and its components in supporting mental well-being[25].

### **Anti-Inflammatory and Anticarcinogenic Effects**

The nutrients in matcha tea are 60–70% insoluble ingredients such as fat-soluble vitamins, insoluble dietary fibers, chlorophylls and proteins[10]. Green tea and coffee consumption may decrease the risk of some types of cancers[32]. Specific components of matcha such as catechins, caffeine and theanine are well studied and have been associated with multiple health-promoting effects. The concentrations of bioactive compounds are higher in matcha tea than in other types of green tea[10]. There is considerable evidence that tea polyphenols, in particular (–)epigallocatechin-3-gallate, inhibit enzyme activities and signal transduction pathways, resulting in the suppression of cell proliferation and enhancement of apoptosis, as well as the inhibition of cell invasion, angiogenesis and metastasis[33]. Matcha is one of the richer sources of flavonoids, especially rutin. Rutin is a compound that has an antioxidant effect and belongs to the group of polyphenols. Additionally, it helps to seal blood vessels, has anti-inflammatory properties and it also supports the immune system. Infusions made from matcha tea, particularly from the second and third harvests, can be a valuable source of antioxidants and can be used in the prophylaxis of illnesses with a free-radical basis[35].

### **Conclusion**

Matcha offers a distinct advantage over other caffeine-containing beverages due to its unique composition and long-lasting effects. Its distinctive blend of L-theanine, caffeine and antioxidants, particularly EGCG, is believed to possess anti-inflammatory properties, which may help reduce markers of inflammation in the body and potentially lower the risk of diseases linked to chronic inflammation. Regular consumption of matcha has been associated with an increased antioxidant status in the body, indicating its potential role in health maintenance and disease prevention. Moreover, the antioxidants found in matcha may support skin health by protecting against UV radiation and slowing the aging process. While current research is promising, further studies, particularly involving human populations, are necessary to fully understand the mechanisms and long-term benefits of matcha's antioxidant properties.

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Since this is a review paper, our work does not contain new data or analyses. Consequently, there are no databases or data accessibility to outline. The details and conclusions presented in this review are derived from previously published studies, which can be accessed through their respective sources as mentioned in the references section.

**Conflict of interest:**

The authors declare no conflict of interest.

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