

EFFECTS OF GREEN TEA ON BRAIN FUNCTIONS: REVIEW

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Abstract

*Green tea (*Camellia sinensis*) has been eaten for thousands of years as a beverage. Numerous claims have been reported and studied about the advantages of its ingestion. As green tea is undergoing a rise in popularity in Western society and as it is consumed every day by millions of people around the world, it is important to consider its impact on the human brain. The aim of this study is to examine the current state of awareness in the literature on the effects of green tea or green tea extracts, L-theanine and epigallocatechin gallate, on general neuropsychology, on cognition sub-category and on human brain functions, on both constituents of green tea. The study found evidence that green tea affects psychopathological symptoms (e.g. anxiety reduction), cognition (e.g. memory and concentration benefits) and brain activity (e.g. activation of working memory seen in functional MRI). A single constituent of the liquid should not be attributed to the effects of green tea. This is exemplified in the observation that under the combined influence of both caffeine and L-theanine, positive green tea effects on cognition was observed, although independent administration of each drug was shown to have a lesser impact.*

Keywords: Brain, Green, Epigallocatechin Gallate (EGCG), L-Theanine, Tea.

I. INTRODUCTION

Camellia sinensis, usually known as green tea, has a long records in human lifestyle and it's been considered to have clinical homes for many years. There has currently been a top notch surge of interest in the fitness benefits of inexperienced tea; that is at the least in part because of the effect of growing intake of green tea in Western countries. An ordeal in rats claims that polyphenols that are specific to green tea would possibly provide functional neuroprotection in Parkinson's ailment. Yet clinical interest in the clinical qualities of inexperienced tea goes beyond neurodegenerative diseases, as pronounced in animal research, showing that green tea polyphenols inhibited the growth of bladder tumour cells. Moreover, there may be proof that inexperienced tea acts as an antiviral agent in HIV-infection, although it continues to be unclear how those findings have to be applied to cutting-edge remedy. A study reviewed the broad spectrum of acknowledged or suspected consequences of green tea[1].

Green tea is prepared from steamed leaves of *Camellia sinensis* in absence of fermentation and consists of many materials: most importantly catechins (30–42% of solid extract weight), of which epigallocatechin gallate (EGCG) is the maximum abundant (sixty five%),

accompanied by using L-theanine (four–6%) and caffeine (three–four%). Black tea includes significantly lower amounts of non-oxidised catechins as it's far produced by means of permitting enzymatic oxidation to occur in harvested leaves of *Camellia sinensis*, ensuing in fewer catechins (3–10%) because of the formation of thearubigins and theaflavins (12–18% and three–6% respectively). It's miles noteworthy that the addition of milk—as is customary in black tea—can lower both the antioxidant characteristics of polyphenols and—in expanded portions (extra than 50 ml in a 2 hundred ml cup)—the attention of L-theanine[2].

The point of interest of the existing overview is at the results of Epigallocatechin gallate (EGCG) and L-theanine, as *Camellia sinensis* is the principle nutritional source of each EGCG and L-theanine. In reality, EGCG possesses antioxidant traits. Several animal studies advised that EGCG can skip the blood-brain barrier, whereas few researchers could not hint detectable quantities of EGCG inside the cerebrospinal fluid of a couple of sclerosis patients after consumption of green tea. More lately, an in-vitro study showed that the human mind capillary endothelial cells forming the blood-brain barrier (BBB) allow the passage of catechins and epicatechins. The bioavailability of EGCG and different green tea catechins appears to be less marginal than formerly proposed if the calculation consists of metabolites derived from colonic microflora: the calculated bioavailability then increases from four% (simply EGCG) to 39% (EGCG which include metabolites). The same study observed that a top plasma attention 0.08 $\mu\text{mol/l}$ of EGCG was found at 1.4 h after oral administration of 11.8 mg EGCG to humans.

However, L-theanine reached in human volunteers a height plasma attention of 26.5 $\mu\text{mol/l}$ at 0.8 hours after oral consumption of 250 ml of inexperienced tea. L-theanine passes through the BBB, interacts with the glutamine transporter and inhibits neural incorporation of glutamine[3].

Despite the fact that several implications of the neuro-modulating properties of green tea have already been investigated, no previous studies reviewed green tea's effect on the human mind. For that reason, the intention of this systematic assessment changed into to evaluate the outcomes of green tea on cognition and human mind capabilities.

A. Green tea and green tea extract (GTE): -

Three experimental research investigated the consequences of green tea or green tea extract: the extreme consequences in wholesome members, one the chronic outcomes in sufferers with slight cognitive impairment.

The neuroimaging observe wherein researchers employed useful magnetic resonance imaging (fMRI) to illustrate that inexperienced tea acted on operating memory by means of growing connectivity from the right parietal lobule to the center frontal gyrus and as a result improved cognitive undertaking overall performance on this way. Every other neuro-imaging examine become the first examine to examine green tea effects by fMRI and discovered that green tea significantly increased activation in the dorsolateral prefrontal cortex (DLPFC); the authors had advised earlier that this changed into an “a priori place of interest”, as it is important in processing operating reminiscence. The overall performance within the working reminiscence project was now not recorded. As a consequence, no cognitive gain become verified, as this have a look at best measured mind activation. Few researchers showed that combined administration of GTE and L-theanine turned into useful to a greater affected subgroup (Mini mental nation examination (MMSE) 21–23) in their pattern of individuals laid low with slight

cognitive impairment (MMSE), in that it extended verbal and visuospatial reminiscence and attention. Random EEGs, equally divided between intervention and manipulate, showed that this remedy drastically more suitable theta waves at some point of the states “eyes open” and “reading” (but not in “eyes closed”)[4].

B. Epigallocatechin gallate (EGCG): -

Four experimental research analysed the results of EGCG. Two of those used did so analysing acute effects in wholesome volunteers. One have a look at changed into constrained to obese sufferers and one to patients with Down's syndrome and examined lengthy-term effects. One observe pronounced that EGCG-intake had a good sized calming impact and relieved stress and multiplied the general interest of alpha-, beta- and theta-waves in the EEG. A low decision brain electromagnetic tomogram (LORETA) showed that the frontal and medial frontal gyrus were the supply of this activation. With close to infrared spectroscopy (NIRS), every other have a look at showed that the management of EGCG decreased cerebral blood waft within the frontal cortex. Few researchers investigated the effects of EGCG in sufferers with Down's syndrome and determined that treatment substantially progressed visual reminiscence recognition after one month, and social functioning and extended plasma homocysteine stages (hcy). It turned into proven with transgenic mice that hcy is a legitimate biomarker for hippocampal twin specificity tyrosine-(Y)-phosphorylation-regulated kinase 1A (Dyrk1A) activity. Consequently, the extended hcy stages have been interpreted as EGCG-mediated inactivation of Dyrk1A—a kinase which whilst over-expressed can be chargeable for some of the neurocognitive deficits in Down's syndrome. A take a look at verified the ability of EGCG to reduce diastolic blood strain and to enhance the hedonic tone. These effects had been a secondary outcome of an investigation of capability insulinmodifying residences of EGCG in overweight sufferers[5][6].

C. L-theanine: -

Ten experimental studies focussed on the effects of L-theanine consumption. 9 of those employed within-concern designs and healthy individuals for acute results, whereas one randomised managed trial investigated those long-time period consequences in a population of sufferers with the diagnosis of schizophrenia or a schizoaffective disorder,. 3 studies investigated the remoted outcomes of L-theanine; one explored the effect of L-theanine blended with GTE, while the alternative six protected caffeine, as L-theanine evidently happens together with caffeine. Of these studies, most effective the results for L-theanine by myself or for L-theanine and caffeine collectively were extracted (and identified as a consequence)—the final results resulting from caffeine on my own changed into not extracted[7].

D. Acute cognitive effects: -

5 experimental move-over research on healthy members focussed on the intense cognitive outcomes of L-theanine blended with caffeine. Few researchers mentioned that blended treatment of L-theanine and caffeine not handiest raised systolic blood pressure, however additionally greater attention (measured by an attention-switching project). Researchers produced proof for the eye-enhancing homes of mixed treatment using an attention switching venture. A take a look at also confirmed that a mixture of L-theanine and caffeine brought about a shorter reaction time and greater accuracy in an interest-switching task. Any other study observed that L-theanine handiest had a beneficial impact on accuracy and hit charge in a “behavioural take a look at” (relative to a placebo circumstance and a no-intervention circumstance) when blended with caffeine, but not on its personal. A look at suggested that consumption of L-theanine on my own led to headache and worsened the overall

performance in a check with seven serial subtractions, whereas the combination of L-theanine and caffeine became favourable for simple reaction time, the response time in testing numerical operating reminiscence, accuracy in speedy visual information processing, and accuracy of sentence verification, as well as improving rankings in behind schedule word recognition time[8].

E. **Acute mood effects:** -

Five experimental cross-over research with healthy contributors investigated acute results on temper: certainly one of EGCG, two of L-theanine and two of L-theanine blended with caffeine. A take a look at stated that EGCG-intake had a sizable calming effect and relieved pressure as shown through visual analogue scales. A researcher discovered that L-theanine decreased the elevation of systolic blood strain due to a stressor-venture in a subgroup they defined as “excessive pressure-responders”; these were participants whose blood pressure changed into multiplied via at the least nine mmhg at some stage in the pressure undertaking underneath placebo treatment. Moreover, this intervention reduced anxiety and anxiety (via decreasing anxiety-anxiety rankings within the profile of mood states). A observe located that L-theanine decreased pressure-brought about coronary heart charge and increases in secretory immunoglobulin A. They also said a discount in perceived stress and tension, using visual analogue scales and a nation-trait anxiety inventory. A study mentioned that mixed treatment of L-theanine and caffeine made the volunteers feel extra alert and much less worn-out. Then again, few researchers—using a totally similar examine setup—discovered no growth in self-pronounced alertness. A study stated that consumption of the combination of L-theanine and caffeine made the contributors feel more alert, less tired and less afflicted with mental fatigue and headache, as shown via a visual analogue scale[9].

F. **Chronic effects (associated with habitual consumption):** -

4 randomised controlled trials on distinct kinds of clinical corporations investigated non-acute outcomes of green tea or inexperienced tea additives. Did so on cognitive outcomes, one with GTE combined with L-theanine and one with EGCG. Two greater trials focussed on results on mood, one of EGCG and one in all L-theanine. Moreover, 4 observational studies investigated lengthy-term cognitive results and one lengthy-term outcomes on mood of habitual inexperienced tea intake on samples of the overall populace[10].

G. **Effects on brain function:** -

Six experimental move-over studies on healthful contributors produced consequences on brain feature: with GTE with EGCG, one with just L-theanine and one with L-theanine combined with caffeine. Additionally, one randomised controlled trial researching the outcomes of a mixture of GTE and L-theanine contained outcomes touching on mind capabilities. The neuroimaging study by using a researcher hired practical magnetic resonance imaging (fMRI) to illustrate that green tea inside the form of GTE acted on operating memory through increasing connectivity from the proper parietal lobule to the middle frontal gyrus and for that reason improved cognitive venture overall performance[11].

II. CONCLUSION

While this systematic overview discovered an affordable amount of evidence that both EGCG and L-theanine show off neuroprotective activity and that L-theanine (and to a lesser diploma of EGCG) have an impact on temper, the extracted statistics suggests that the diverse upgrades in cognitive colleges connected to inexperienced tea intake are not the effect of a unmarried aspect. The upgrades in cognitive tasks inside the reviewed studies are strongly

connected to the presence of both caffeine and L-theanine. In addition research is wanted to set up the minimum dosage of green tea or inexperienced tea components to reliably elicit both acute or chronic outcomes, in addition to what minimum period of time will bring about long-time period inexperienced tea outcomes. Another query for in addition research to investigate is the interplay of the 2 compounds and to set up whether EGCG too could similarly enhance cognitive overall performance in aggregate with caffeine. Additionally, greater studies is wanted to corroborate the claim of EGCG consequences on temper. Given the success of L-theanine supplementation of antipsychotic remedy for schizophrenia or schizoaffective disorder, similarly research is wanted to discover different psychiatric treatments that could enjoy the anxiolytic homes and reduction in high-quality signs from L-theanine. The extracted data indicates that it'd be proper for greater Westerners to alternate their way of life to include recurring, every day intake of green tea of at the least a hundred ml according to day, to be able to guard their neurocognitive characteristic.

III. REFERENCES

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