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File: ■ Green Tea (*Camellia sinensis*)
■ Reward Learning
■ Depression

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RE: Green Tea Intake Improves Reward Learning and Symptoms of Depression

Zhang Q, Yang H, Wang J, et al. Effect of green tea on reward learning in healthy individuals: a randomized, double-blind, placebo-controlled pilot study. *Nutr J*. 2013;12(1):84. doi: 10.1186/1475-2891-12-84.

Green tea (*Camellia sinensis*) extracts, as well as their main component, the polyphenol epigallocatechin-3-gallate (EGCG), reportedly have antistress, anticancer, and antioxidant effects. Recent studies suggest a beneficial association between green tea consumption and symptoms of depression; however, the underlying mechanism behind that association is unclear. Anhedonia, the inability to experience pleasure, is a characteristic of depression, marked by reduced pleasure, altered motivation, and disturbed reward learning.[1,2] A reduced reward-learning function has been linked to persistent anhedonia in depressed patients.[3] These authors hypothesized that chronic treatment with green tea would improve reward learning compared with a control treatment. They conducted a randomized, double-blind, placebo-controlled study to evaluate the effects of green tea on reward learning and the clinical outcome of depression.

Through local advertisements, the authors recruited 74 healthy subjects aged between 18 and 34 years (mean age = 25.7 ± 4.7 years) for the study, conducted from March to November 2012 at Shandong University in Shandong, China. Before enrollment, the subjects underwent thorough screening that included a medical history interview, physical examination, determination of typical tea consumption patterns, and clinical laboratory tests. Subjects were excluded if they drank > 3 cups of tea/day; however, the authors do not state whether those participating continued to drink less than that amount during the trial. The Montgomery-Asberg Depression Rating Scale (MADRS) and a 17-item Hamilton Rating Scale for Depression (HRSD-17) were used to measure symptoms of depression at baseline and at the end of the trial.

At baseline, the subjects were similar in age, education, and behavioral phenotype as assessed by MADRS and HRSD-17 scores. Of the original 74 subjects, 46 completed the study – 22 in the placebo group and 24 in the green tea group.

After being randomly assigned to either the green tea or placebo treatment, the subjects were asked to take 1 package containing 400 mg of either green tea powder (Yifutang Tea Co., Ltd.; Hangzhou, Zhejiang Province, China) or cellulose (placebo) 3 times daily for 5 weeks. The green tea powder was dissolved in hot water and consumed 30 minutes after each meal. Composition of the green tea powder was determined by high-performance liquid chromatography (HPLC) to be 45.6% EGCG, 16.7% epigallocatechin, 11.4% epicatechin-3-gallate, 6.8% epicatechin, and 0.6% caffeine.

The authors explain that a monetary incentive delay (MID) task is used "to assess the effort-related aspects of central reward processing for investigations of the relationship between depressive behavior and impairments in reward learning."[4] In this study, the MID task included 30 potential reward trials, 30 no-reward trials, and 30 periods of fixation. Trials lasted between 7.5 and 10.5 seconds; the total duration of the task was 13.5 minutes. Cues signaled potential reward outcomes or no-reward outcomes. The subjects could win or avoid losing money by pressing a button during target presentation. If a subject pushed the target in a rewarding trial, he or she earned 1 Yuan. The subjects were told they would receive one-third of the money they won during the MID in each session at the end of the study.

The statistical analyses of the reward learning and depressive behavioral data were performed by using repeated-measure analysis of variance (ANOVA). For the MID task, ANOVA showed that the green tea group had a significantly shorter reaction time in response to the reward trial compared with the placebo group ($P<0.01$), suggesting that those treated with green tea exhibited significantly increased reward learning. No differences were observed in the reaction time in the no-reward trials between the 2 groups. "It has been evidenced that reduced dopamine neurotransmission might contribute to the anhedonia and loss of behavioral incentive in depressive disorder, therefore it is important to examine the regulatory role of green tea on the brain circuitry activated by reward learning," write the authors.

Furthermore, the data revealed decreased MADRS ($P<0.05$) and HRSD-17 ($P<0.001$) scores after treatment with green tea compared with baseline values. For those in the placebo group, the MADRS and HRSD-17 scores did not change significantly during the trial. Compared with the control treatment, the green tea produced significantly greater improvements in the MADRS ($P<0.01$) and HRSD-17 ($P<0.001$) total scores.

In earlier studies, green tea and its polyphenol EGCG have exhibited protective effects against neurodegenerative diseases, including Parkinson's disease and Alzheimer's disease.

The findings in this study suggest that the administration of green tea for 5 weeks was beneficial for reward learning and the improvement of depressive symptoms. "We propose that green tea would probably have the potential for normalization of anhedonia through improve[d] reward learning and have implications for the prevention of depression," conclude the authors. The authors do not state if there was a washout period prior to the beginning of the study; whether or not the participants were allowed to drink green tea other than the test material; and whether or not the participants were allowed to have other forms of caffeine, such as coffee (*Coffea* spp.).

—Shari Henson

References

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