Green Tea Intake and Cognitive Decline in the Elderly: A Dose-Response and Cross-Cultural Meta-Analysis

Wang, Xiaohan (School: Maharishi School)

Cognitive decline poses a significant public health challenge among aging populations. Green tea contains epigallocatechin gallate (EGCG), a catechin widely hypothesized to protect against neurodegeneration. This dose–response meta-analysis investigated the association between standardized EGCG intake and cognitive outcomes in older adults. We systematically searched PubMed, Embase, CNKI, Web of Science, and J-STAGE from 1990 through 2025, identifying observational studies and trials that reported odds ratios (ORs) or hazard ratios (HRs) for cognitive impairment, dementia, or related outcomes. Green tea intake (cups/day) or supplement doses were converted to mg/day of EGCG using literature-based assumptions. A random-effects model estimated pooled effect sizes, while restricted cubic splines allowed non-linear dose–response assessment. Subgroup analyses (e.g., region, outcome type), meta-regression, and influence diagnostics were performed, and publication bias was examined via funnel plots, Egger's, and Begg's tests. Overall, higher EGCG consumption was associated with a significantly reduced risk of cognitive decline (pooled OR < 1.0), with the strongest protection observed around 200–300 mg/day (2–3 cups of traditional brew). Subgroup analysis suggested a more pronounced effect among Asian populations. The leave-one-out analysis indicated no single study unduly influenced the result, and publication bias tests did not reveal substantial small-study effects. These findings provide evidence of a protective dose–response relationship between moderate daily EGCG intake and cognitive health, supporting further clinical trials to confirm causality and elucidate underlying mechanisms.

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