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Matcha Green Tea and Cardiometabolic Health

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Abstract
Matcha green tea had attracted interest as a functional beverage, but its cardiometabolic benefits had often been inferred from studies of conventional green tea or concentrated catechins. This narrative review evaluated matcha-specific human findings alongside the broader tea literature to clarify their clinical relevance. Publications addressing composition, metabolic outcomes, vascular function, liver health, microbiota, and safety were synthesized thematically, with direct matcha evidence distinguished from indirect evidence. Small human studies reported increased fat oxidation during exercise and altered gut microbial composition. However, these findings did not establish sustained weight loss or prevention of metabolic disease. Broader green tea trials and meta-analyses suggested modest improvements in selected lipid, glucose, and blood-pressure markers, but differences in formulations and populations limited extrapolation to matcha. No direct cardiovascular outcome evidence was established in the reviewed matcha literature. Concentrated catechin supplements also differed from traditional beverages and had been associated with liver enzyme elevations at high exposures. Overall, the evidence supported matcha as a possible component of a healthy dietary pattern rather than an established treatment for obesity, diabetes, hypertension, dyslipidemia, or cardiovascular disease. Standardized, adequately powered, longer-term randomized trials were needed to determine whether its biological effects translated into clinically meaningful benefits.
Keywords: epigallocatechin gallate; insulin resistance; lipid metabolism; endothelial function; gut microbiota; dietary polyphenols

INTRODUCTION

Obesity, type 2 diabetes mellitus (T2DM), hypertension, dyslipidemia, and metabolic dysfunction-associated steatotic liver disease (MASLD) contribute to cardiovascular risk. Interest in dietary approaches has extended to matcha, a powdered green tea marketed for weight control, glucose regulation, and vascular protection. However, evidence supporting these claims has often combined substantially different tea preparations (Kochman et al., 2020; Kosik-Bogacka & Piotrowska, 2025; Zamani et al., 2023).

Matcha is produced from Camellia sinensis leaves that are shaded before harvesting and subsequently processed into a fine powder. Consumption of the whole powdered leaf differs from drinking an infusion. Matcha contains catechins, including epigallocatechin-3-gallate (EGCG), caffeine, L-theanine, phenolic acids, chlorophyll, and fiber; their concentrations vary with cultivation, processing, storage, and preparation (Kika et al., 2024; Kochman et al., 2020; Weiss & Anderton, 2003).

The central problem is whether biological plausibility and benefits observed with green tea or isolated catechins translate into clinically relevant effects of matcha itself. This review aimed to evaluate that distinction across metabolic, vascular, hepatic, and microbiome outcomes. Its contribution was an integrated comparison of direct matcha evidence with indirect tea evidence, identifying where clinical interpretation exceeded the available findings.

METHOD

This narrative review synthesized the publications assembled for the manuscript rather than conducting a systematic review or meta-analysis. The evidence base included compositional studies, small matcha interventions, mechanistic reviews, meta-analyses of green tea interventions, observational tea cohorts, and safety assessments. The sequence of synthesis was to characterize the intervention, separate matcha studies from other tea preparations, organize findings by outcome, and interpret their clinical relevance and limitations.

Clear aims, appropriate referencing, scientific reasoning, and transparent description of evidence selection are recognized quality domains for narrative reviews (Baethge et al., 2019). The original literature-search dates, databases, complete search strings, screening counts, and exclusion decisions were not documented. Selection completeness therefore could not be verified, and this review did not claim exhaustive retrieval or formal risk-of-bias assessment. No pooled effect estimate was calculated. Direct human findings were given greater interpretive weight than preclinical mechanisms, while surrogate outcomes were distinguished from clinical events.

RESULTS AND DISCUSSION

Composition and biological mechanisms

The biological interest surrounding matcha is largely derived from its complex phytochemical profile. Major catechins include EGCG, epigallocatechin, epicatechin gallate, and epicatechin. EGCG has received particular attention because of its potential effects on oxidative stress, inflammation, vascular signaling, lipid metabolism, and glucose homeostasis (Kochman et al., 2020; Weiss & Anderton, 2003).

An analytical comparison reported higher EGCG content in matcha than in one conventional green tea comparator, but this did not establish uniform superiority across commercial products (Weiss & Anderton, 2003). Differences in composition and the small amount consumed per serving also limit assumptions about nutritional exposure (Kika et al., 2024). L-theanine has been investigated in cardiovascular signaling, although much of that evidence remains mechanistic or preclinical (García-Niño et al., 2026).

EGCG may influence oxidative stress, inflammatory signaling, nitric oxide availability, and glucose and lipid metabolism (Eng et al., 2018; Yamagata, 2020). In a small, non-randomized pilot study, matcha combined with calorie restriction was associated with changes in selected inflammatory and oxidative markers, but several metabolic outcomes did not differ significantly from diet alone (El-Elimat et al., 2022). These findings provided biological plausibility without demonstrating prevention of cardiometabolic disease.

Fat oxidation and body weight

Direct matcha trials provide some evidence for altered substrate utilization during exercise. In a randomized crossover study involving 13 women, matcha consumption increased fat oxidation during a 30-minute brisk walk compared with control, although the absolute difference was modest (Willems et al., 2018). The investigators specifically cautioned that the effect should not be overstated as a weight-loss strategy.

A subsequent randomized placebo-controlled crossover trial evaluated three weeks of daily matcha intake in 12 women. Matcha increased fat oxidation during moderate-intensity exercise and reduced carbohydrate oxidation without significantly changing overall energy expenditure (Willems et al., 2021). These findings support a short-term metabolic effect on substrate utilization but do not establish sustained weight loss.

Increased fat oxidation during exercise does not establish sustained adipose-tissue loss. In the 12-week pilot study by El-Elimat et al., participants receiving matcha plus a low-calorie diet did not have significantly better post-treatment anthropometric outcomes than those following the diet alone (El-Elimat et al., 2022). Broader green tea meta-analysis suggested modest weight and body-mass-index reductions, with variability by intervention characteristics (Lin et al., 2020). Direct evidence remained insufficient to establish matcha as a weight-loss intervention.

Glucose regulation and lipid metabolism

Proposed EGCG mechanisms include modulation of insulin signaling, glucose transport, hepatic gluconeogenesis, and AMP-activated protein kinase pathways (Eng et al., 2018). However, matcha-specific clinical evidence was inadequate to determine glycemic efficacy;

concurrent calorie restriction and non-randomized allocation limited interpretation of the pilot study (El-Elimat et al., 2022).

The larger evidence base for conventional green tea is more informative, but results have not been entirely consistent. A systematic review and meta-analysis of 27 trials involving 2,194 participants found a small reduction in fasting blood glucose with green tea supplementation but no significant improvement in fasting insulin or HbA1c (Xu et al., 2020b).

Conversely, a more recent 2024 meta-analysis involving 15 studies and 722 patients with T2DM reported improvements in fasting glucose, HbA1c, and insulin resistance following green tea interventions (Jia et al., 2024). Differences in inclusion criteria, study populations, formulations, doses, and analytical approaches may explain some of the inconsistent conclusions between meta-analyses.

A broader green tea meta-analysis also reported modest improvements in selected glucose and lipid markers (Zamani et al., 2023). Differences in formulations, baseline metabolic status, and study duration limit comparison. These findings cannot establish matcha as a glucose-lowering therapy or justify replacing established diabetes care.

A meta-analysis of 31 randomized trials involving 3,321 participants found that green tea consumption reduced total cholesterol by approximately 4.7 mg/dL and LDL cholesterol by approximately 4.6 mg/dL. No significant improvement in HDL cholesterol or triglycerides was demonstrated in the overall analysis (Xu et al., 2020a).

The limited matcha pilot evidence suggested possible changes in HDL cholesterol but did not establish a reliable lipid-lowering effect (El-Elimat et al., 2022). Consequently, the lipid findings from green tea trials should be interpreted as indirect support for further research rather than evidence for treating dyslipidemia with matcha.

Blood pressure and cardiovascular outcomes

Catechins have been investigated for effects on endothelial nitric oxide signaling, oxidative stress, and vascular inflammation (Eng et al., 2018; Yamagata, 2020). A GRADE-assessed meta-analysis of green tea supplementation reported small average blood-pressure reductions, with substantial heterogeneity (Rezaei et al., 2025). The magnitude and inconsistency of these changes did not establish matcha as an antihypertensive intervention. Caffeine exposure may also affect individual tolerability and vascular responses (Kochman et al., 2020).

Observational studies of conventional green tea have also generated important epidemiological evidence. In the Ohsaki Study involving more than 40,000 Japanese adults, greater green tea consumption was associated with lower all-cause and cardiovascular mortality, with particularly strong inverse associations reported for stroke mortality (Kuriyama et al., 2006). Because the study was observational, residual confounding and healthy-user effects cannot be excluded.

More recently, a 2024 meta-analysis of 38 prospective cohort datasets including almost two million participants found that higher tea consumption was associated with lower all-cause and cardiovascular mortality. Moderate consumption appeared sufficient to capture much of the observed association (Kim & Je, 2024).

These observational findings predominantly concerned tea consumption rather than matcha. The reviewed matcha literature did not establish reductions in myocardial infarction, stroke, heart failure, or cardiovascular mortality. Favorable biomarkers and mechanistic effects therefore should not be described as demonstrated cardiovascular prevention.

Liver health and the gut microbiota

A review of matcha, tea catechins, and MASLD described potentially favorable effects on hepatic lipid metabolism, oxidative stress, and liver-related markers, but combined heterogeneous animal and human interventions (Kosik-Bogacka & Piotrowska, 2025). A

green tea meta-analysis found no significant overall improvement in liver enzymes, although some subgroup findings favored participants with fatty liver disease (Mahmoodi et al., 2020). Neither evidence base established matcha as a MASLD treatment.

A randomized, double-blind trial assigned 33 participants to matcha or placebo for two weeks and identified changes in gut microbial composition (Morishima et al., 2023). Its short duration and microbiome endpoints did not establish improved insulin sensitivity or reduced cardiovascular risk. Microbial changes should therefore be treated as exploratory mechanistic findings, rather than clinical benefits.

Safety and preparation context

Matcha beverages and concentrated catechin supplements represent different exposures. Caffeine-containing matcha may cause sleep disturbance, palpitations, anxiety, or gastrointestinal discomfort in susceptible consumers, depending on intake and concurrent caffeine sources (Kochman et al., 2020).

The European Food Safety Authority considered traditional green tea infusions generally safe at customary intake levels, while supplemental EGCG exposures of 800 mg/day or more were associated with increased transaminases in intervention studies (EFSA ANS Panel, 2018). This observation was not a validated safe-intake threshold for matcha powder, whose composition and whole-leaf exposure differ from infusions and supplements.

Reviews of green tea extracts described uncommon liver-related adverse events and emphasized the relevance of concentrated preparations and high catechin exposure (Hu et al., 2018; Isomura et al., 2016). Safety findings for these products should not be transferred directly to ordinary matcha beverages. Conversely, customary beverage use does not establish the safety of every high-dose matcha or catechin supplement.

Preparation also changes dietary relevance. Unsweetened matcha and beverages containing substantial added sugar, syrup, cream, or sweetened milk have different energy and nutrient profiles. Any proposed dietary benefit should account for the complete beverage and the food or drink it replaces.

Evidence limitations and research priorities

Most direct matcha studies were small and brief; exercise studies involved limited female samples, and the weight-management pilot was non-randomized (El-Elimat et al., 2022; Morishima et al., 2023; Willems et al., 2018; Willems et al., 2021). Product composition, serving size, study populations, and comparator conditions differed. Green tea extracts and isolated EGCG are not equivalent to whole powdered leaves. Meta-analytic estimates for those interventions therefore do not resolve uncertainty about matcha.

The narrative selection process introduced additional risk of incomplete retrieval and selective interpretation. No formal certainty grading or quantitative synthesis was performed. Table 1 summarizes the distinction between direct and indirect evidence; its interpretations are descriptive rather than formal evidence grades.

Future trials should quantify catechins, EGCG, caffeine, and L-theanine in standardized products; use appropriate dietary comparators; and assess adherence and adverse events. Adequately powered interventions lasting several months should evaluate body composition, HbA1c, ambulatory blood pressure, lipid profiles, liver fat, and vascular function. Comparisons with conventional green tea would help determine whether whole-leaf matcha offers additional benefit. Longer-term outcome studies would be required to test cardiovascular protection.

CONCLUSION

This review distinguished matcha-specific findings from the broader tea literature, addressing the gap between popular cardiometabolic claims and direct clinical evidence. Small studies supported effects on exercise-related fat oxidation and microbial composition,

while broader green tea research suggested modest changes in selected risk markers. These findings did not establish matcha as a treatment for obesity, diabetes, hypertension, dyslipidemia, MASLD, or cardiovascular disease. Unsweetened matcha may fit within a healthy dietary pattern, but claims of therapeutic benefit require standardized, adequately powered, longer-term clinical trials.

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