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Beyond Bioavailability — What Research Shows About Flavanols' Effectiveness

Analysis by Dr. Joseph Mercola | December 22, 2025

STORY AT-A-GLANCE

- Flavanols are plant compounds in cocoa, berries, and tea with low bioavailability, meaning only a small portion enters the bloodstream
- A new animal study found that oral flavanol doses of 25 to 50 milligrams per kilogram (mg/kg) activated the subjects' brains within minutes
- Flavanols are a type of flavonoid within the polyphenol family. This hierarchy clarifies their differences and explains why foods have unique combinations that offer specific health benefits
- If you choose cocoa flavanol supplements, don't fall for flashy marketing; whenever possible, stick to a nutritious food-first approach
- Along with consuming flavanol-rich foods, pairing them with regular physical activity and a nutrient-dense, plant-focused diet helps support long-term brain health and cardiovascular resilience

When you bite into a square of dark chocolate, it's more than just flavor — it's a delightful experience. The rich cocoa notes blend beautifully with a hint of bitterness, followed by a dry, puckering sensation — called astringency — that lingers for a while after the sweetness has softened. This is a gentle hint from flavanols, those special plant compounds that give chocolate its unique taste and may even boost brain health.

Researchers now believe these compounds could do more than just satisfy your taste buds; they might help support your brain. A new study looks into this fascinating connection, and the results might surprise you.

A Study Exploring How Flavanols Sparked Brain Activity

In a recently published study, in Current Research in Food Science,[1] a team of researchers from Shibaura Institute of Technology, explored how flavanols — plant compounds found in cocoa, berries, and tea — can influence the brain almost instantly.[2] Instead of acting through digestion, the researchers tested whether the sharp, astringent taste of flavanols could send signals directly to the nervous system, boosting alertness and memory.[3]

- **What the researchers focused on —** This experiment studied rapid taste-driven brain responses, suggesting that flavanols influence cognition via sensory activation, rather than absorption. This explains how these compounds are so beneficial despite their poor bioavailability[4] and limited ability to enter the bloodstream.

- **The hypothesis that started it —** The researchers proposed that flavanols activate the locus coeruleus, the brain's "alert center," by triggering sensory nerves in the mouth. This brain region releases noradrenaline, a neurotransmitter that increases alertness and improves short-term memory. As study author Yasuyuki Fujii, Ph.D., explained:[5]

> *"Flavanols exhibit an astringent taste. We hypothesized that this taste serves as a stimulus, transmitting signals directly to the central nervous system (comprising the brain and spinal cord). As a result, it is thought that flavanol stimulation is transmitted via sensory nerves to activate the brain, subsequently inducing physiological responses in the periphery through the sympathetic nervous system."*

- **Methodology and subjects —** To test this, the researchers used 10-week-old laboratory mice and divided them into two groups. One group received flavanol extracts (comparable to concentrated dark chocolate compounds), and the other served as a control. The flavanol doses were 25 mg/kg and 50 mg/kg of body weight, while controls received distilled water.

  The team then evaluated memory using a Novel Object Recognition (NOR) test, a standard behavioral measure where mice need to distinguish between familiar and new objects.[6,7]

- **Researchers saw a boost in memory and activity —** Within the same hour, flavanol-treated mice performed about 30% better on memory tasks[8] and showed greater movement and exploratory behavior, indicating a measurable rise in cognitive arousal when compared to controls.[9]

- **The alertness pathways were activated —** Shortly after flavanol intake, dopamine, noradrenaline, and their metabolites rose sharply, too fast to be explained by digestion. Noradrenaline spiked in the locus coeruleus, the brain's main alertness center, and other regions tied to sleep regulation and reward also became active.

  At the same time, the brain began producing more of the enzymes and transport proteins necessary for the production and movement of noradrenaline. In simple terms, the taste of flavanols flipped the brain's "focus switch," boosting alertness, motivation, and readiness to respond.[10]

- **Additional findings —** Flavanol intake not only improved memory but also triggered mild stress responses in the brain. Urinary catecholamine levels, which are stress hormones, increased, and activity in the hypothalamic paraventricular nucleus (PVN), a key stress-regulation region, also rose.[11]

- **The takeaway —** The team concluded that flavanols enhance short-term memory and alertness by activating the brain's alert system through taste. As Fujii remarked:[12]

> *"Stress responses elicited by flavanols in this study are similar to those elicited by physical exercise. Thus, moderate intake of flavanols, despite their poor bioavailability, can improve the health and quality of life."*

Cutting the Confusion — Polyphenols, Flavonoids, and Flavanols

When you read about plant compounds, terms like polyphenols, flavonoids, and flavanols often appear side by side, which can be confusing. The study focuses on flavanols, but here's how to differentiate between these terms so you can see how they fit into the bigger picture:[13]

- **Polyphenols are the umbrella group —** They're plant compounds with antioxidant properties, found in fruits, vegetables, tea, coffee, and wine. Flavonoids are one of their largest subgroups.
- **Flavonoids branch into several subclasses —** These include flavanols, flavonols, flavones, isoflavones, and anthocyanidins. They influence plant color, defense, and health benefits.[14]
- **Flavanols are the focus of the featured study —** Also called catechins or flavan-3-ols because of a hydroxyl group in their structure, flavanols are abundant in cocoa, tea, and berries. Two well-known examples are epicatechin and gallocatechin, which contribute to the dry, puckering sensation in dark chocolate.[15]

There are 8,000 polyphenols to date, and 4,000 of those are flavonoids. If you want to learn more about how these plant compounds protect your body, read "**What Are Polyphenols and Why Do We Need Them?**"

How Flavanols Work Inside Your Body

Flavanols don't act immediately after you eat them — they go through a complex process before they are used by your body. These compounds interact with your gut, blood vessels, and cells in ways that support vascular and cognitive function. Here's what

happens step by step:

- **Digestion and initial breakdown —** When you consume flavanol-rich foods, the compounds pass through the stomach largely unchanged. Most flavanols are too large to be absorbed immediately, so they move into the small intestine for further processing.[16]

- **Absorption and microbial metabolism —** In the small intestine, some smaller flavanol molecules slip into your bloodstream. But most of them keep going to your colon, where your gut bacteria get involved. These microbes break flavanols down into smaller pieces called metabolites, and these are the forms your body can use.[17]

- **Transport and Cellular Action —** Once these metabolites enter your blood, they travel to different parts of your body. They interact with your blood vessels, helping them relax and improve circulation by boosting nitric oxide production. They also help reduce oxidative stress, which means less damage to your cells over time.[18]

This journey explains why flavanols don't just act as antioxidants in your gut — they become active compounds that circulate and interact with your blood vessels and brain. Understanding this process helps you see how it enables the body to be more resilient and responsive.

Health Benefits of Dietary Flavanols

Due to the wide range of health benefits they offer, flavanols have garnered attention for their unique structure and potent effects on the body. These natural compounds act as antioxidants and support key cellular processes, influencing various areas of your body.

- **Cocoa flavanols boost brain oxygenation and mental performance under stress —** In a randomized, double-blind study in Scientific Reports, 18 healthy adults were given two cocoa formulas, one rich in flavanols and one with very few. Two hours after consumption, participants inhaled 5% carbon dioxide, a vascular stressor 100 times stronger than normal air to measure brain blood flow and oxygenation.[19]

Those who consumed high-flavanol cocoa showed three times more oxygenated hemoglobin and performed cognitive tasks 11% faster under high demand. Flavanols are likely to enhance nitric oxide availability, improving blood vessel dilation and cerebral oxygenation. Interestingly, a few participants showed no added benefit, due to already optimal vascular health. As lead researcher Catarina Rendeiro told ZME Science:[20]

> *"We have known for many years that flavanols from cocoa (in particular) can improve vascular function in humans by improving vessel/arterial function. These benefits are apparent even after one single dose. However, the extent to which some of these benefits could translate into the brain vasculature was less clear ...*
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> *Consuming foods rich in flavanols, such as grapes, green tea, apples, berries can provide levels of flavanols that are beneficial for brain function. The fact that we can see benefits even in a perfectly healthy brain it is good news for all of us."*

- **These plant extracts keep your blood vessels healthy —** A randomized, double-blind crossover trial published in The Journal of Physiology[21] investigated whether flavanols can protect blood vessel function during prolonged sitting, a known cause of temporary vascular impairment.

  The study enrolled 40 healthy men who consumed either a high-flavanol cocoa drink containing 695 mg of flavanols or a low-flavanol version before sitting for two hours. Researchers then measured flow-mediated dilation (FMD) in major arteries to assess how well the blood vessels widened in response to increased blood flow.

  The results were striking — FMD declined noticeably in the low-flavanol group but remained stable in the high-flavanol group, even though overall blood flow patterns were similar. This indicated that flavanols help preserve vascular responsiveness during inactivity, offering protection that even high fitness levels did not provide.

In an article in Medical News Today, Eamon Laird, an assistant lecturer in human nutrition, emphasized how quickly the effects appeared and why the findings matter:[22]

> *"It is surprising we can see such strong effects from one off dose on negative effects of sitting down. These findings [...] are highly significant and could be an easy, enjoyable way to try and stave off effects of sitting down. However, it is not a magic bullet and we shouldn't take this study as evidence to eat chocolates everyday as they contain fat, sugar, and energy!"*

Dr. Christopher Yi, a board-certified vascular surgeon at MemorialCare Orange Coast Medical Center in Fountain Valley, California, who was not involved in the study, also weighed in on the trial's significance and why movement still plays a key role in vascular health:[23]

> *"Flavanol consumption may buffer the short-term vascular stress caused by sitting, but movement remains the most powerful tool for vascular health,"* he said. "Even small movements, such as calf raises, fidgeting, or using a foot pedal under your desk, can keep circulation active and reduce the negative effects of prolonged immobility."

- **Cocoa flavanols may help slow "inflammaging" —** Inflammaging refers to the slow, low-grade inflammation that builds with age and fuels chronic diseases such as heart disease, diabetes, and cognitive decline. A new analysis based on the COcoa Supplement and Multivitamin Outcomes Study (COSMOS) trial and published in Age and Ageing journal, followed 598 older adults who took either a 500 mg cocoa extract supplement or a placebo daily for two years.[24]

  The researchers tracked five key biomarkers of aging-related inflammation and found that high-sensitivity C-reactive protein (hs-CRP) levels decreased by 8.4% annually, indicating a decline in overall inflammation. Most of the other

inflammation markers didn't change much, while interferon-gamma rose slightly — about 6.8% per year — suggesting the cocoa extract gently adjusted immune activity rather than suppressing it.[25]

Howard Sesso, Sc.D., M.P.H., an associate epidemiologist and one of the study's authors, explained the motivation behind their work:[26]

> *"Our interest in cocoa extract and inflammaging started on the basis of cocoa-related reductions in cardiovascular disease. We also appreciate the important overlap between healthy aging and cardiovascular health, where aging-related inflammation can harden arteries and lead to cardiovascular disease.*
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> *Because of that, we wanted to see whether multi-year cocoa extract supplementation versus a placebo could modulate inflammaging — and the data suggests it does."*

Researchers noted that the steady reduction in hs-CRP may help explain the 27% decrease in cardiovascular mortality previously observed in the larger COSMOS trial.[27] They also found early signs that cocoa flavanols may influence cell-signaling pathways, support endothelial function,[28] and help modulate NF-κB, a master regulator of inflammation that becomes overactive with age.[29]

> *"This study calls for more attention to the advantage of plant-based foods for cardiovascular health, including cocoa products rich in flavanols ... It reinforces the importance of a diverse, colorful, plant-based diet — especially in the context of inflammation,"* said Sesso.[30]

Getting More Flavanol Out of Your Food

Not all flavanol-rich foods contain the same amount of these compounds, so variety is important. As Gunter Kuhnle, professor of Nutrition and Food Science at the University of Reading, explained, achieving approximately 500 mg of flavanols per day requires a

combination of foods rather than relying on a single source. If you're planning on incorporating more flavanols in your diet, here's a handy table:[31]

Foods	Serving	Grams (g) per serving	Servings for 500 mg/day
Fruits			
Apples (with skin)	Large	223 g	4.2
Blueberries	Cup	148 g	6.2
Raspberries	Cup	123 g	14.7
Blackberries	Cup	144 g	2.9
Cherries (sweet)	Cup	154 g	9.9
Cranberries	Cup	100 g	4.1
Nectarines (yellow)	Large	156 g	14.1
Peaches	Large	175 g	6.9
Pears	Large	230 g	11.8
Plums	Cup	165 g	3.2
Strawberries	Cup	166 g	6.8
Beverages			
Green tea	Cup	245 g	2.5
Black tea	Cup	237 g	7.9

Foods	Serving	Grams (g) per serving	Servings for 500 mg/day
Vegetables			
Pinto beans	Cup	193 g	1.5
Kidney beans	Cup	184 g	1.8
Fava Beans	Cup	109 g	2.6
Cereal grains			
Buckwheat flour	Cup	120 g	11.6
Sorghum grain (Millet)	Cup	192 g	0.8

Source: University of Reading Research Blog, June 2023[32]

Green tea is one of the most efficient options: about two-and-a-half cups may meet the daily target. Just under a cup of millet (a sorghum grain) also works. However, if you were to try to obtain that amount from raspberries alone, you would need nearly 15 cups. Instead, I recommend combining different foods, spreading them throughout your daily meals.

Cocoa products deserve a place in this mix. Cocoa extract is often used in research because it contains multiple types of flavanols and minimally processed cocoa powder or high-quality dark chocolate still contributes significantly to your intake. Pairing cocoa with fruits, and tea is a simple way to increase flavanol diversity in your diet.

Cocoa offers many health benefits beyond what's listed here. You can explore more in the article "**Could Chowing Down on Cocoa Fix Your Heart?**"

Clarifying the Difference Between Cocoa Extract and Chocolate

Most benefits in the COSMOS study about flavanols come from standardized cocoa extract, a concentrated form used in trials, and not chocolate bars. In the trial, participants took a daily 500 mg cocoa flavanol supplement (including 80 mg of epicatechin), a dose that would require eating multiple dark chocolate bars every day to match. Supplements deliver consistent flavanol levels without the added sugar, fat, or calories found in chocolate.[33] For comparison:[34]

Factor	Cocoa extract (standardized)	Dark chocolate
Flavanols	Standardized 500 mg/day (including 80 mg epicatechin)[35]	Varies widely; often unlisted and degraded by processing
Calories per "serving" used in studies	Negligible	~170 calories per 1 oz (28 g)[36]
Sugar content	None	~6.8 g per 1 oz[37]
Standardization	Consistent and clinically tested	Inconsistent; it depends on the bean source and manufacturing
Practicality for study dose	Easy to achieve through daily capsules	Impractical; requires multiple ounces daily
Health focus	Anti-inflammatory and heart health benefits supported by trial data	Primarily sensory and comfort-based

Dark chocolate is fine as an occasional treat — but don't count on it for COSMOS-level benefits. Clinical results come from concentrated cocoa extract, not chocolate bars. Why? The extract delivers consistent flavanol doses, while chocolate varies wildly in

purity and content.

Lauri Wright, Ph.D., RDN, the director of nutrition programs and an associate professor at USF College of Public Health, explained why chocolate alone isn't enough and gave a wise suggestion instead of taking the easy route:[38]

> *"The study's result doesn't imply 'eat more chocolate' — it implies that a purified cocoa flavanol extract, in controlled dose, may have health benefits. In practice, using whole-food sources such as dark chocolate is appealing, but matching the 500 mg flavanol dose is challenging without supplementation ...*
>
> *It's wise to prioritize a flavanol-rich diet such as dark chocolate with minimal processing, berries, tea, grapes, etc. before reaching for supplements. These provide other beneficial nutrients and fiber."*

Take These Steps to Complement a Flavanol-Rich Diet

While flavanols have earned attention for the benefits they bring, they're just one piece of the wellness puzzle. True health comes from a combination of habits that work together to support your body's resilience. Beyond what's on your plate, here are practical ways to complement flavanol-rich foods and create a foundation for long-term vitality.

- **Choose a bioenergetic way of eating —** Since you'll already be incorporating flavanol-rich foods into your day, pair them with a bioenergetic eating style that helps the body rely on glucose as its primary fuel. This supports cleaner energy production, reduces mitochondrial stress, and lays a stronger foundation for overall better cellular function. I explore this approach in depth in my book, "**Your Guide to Cellular Health: Unlocking the Science of Longevity and Joy**."
- **Enjoy green tea daily —** If you're looking for an easy way to bring more flavanols into your day, green tea is one of the most convenient options. It is rich in polyphenols that help calm inflammation and flavanol catechins, which have been linked to

easing nerve discomfort by reducing oxidative stress and supporting balanced cellular signaling.

- **Cook with real fats, not seed oils —** Highly processed seed oils like soybean, canola, corn, sunflower, and safflower are loaded with linoleic acid (LA). This polyunsaturated fat (PUF) disrupts mitochondrial function and metabolic balance. To support cellular health and complement flavanol benefits, choose heat-stable, nutrient-rich fats such as ghee or beef tallow. Aim to keep LA below 5 grams daily, ideally under 2 grams, and use a nutrition tracker to stay on target.

- **Choose a high-quality cocoa flavanol supplement —** If you want to complement your diet with a cocoa flavanol supplement, a few quick steps can help you find a safe, reliable option:

    1. **Look for standardized flavanol content —** Choose products that clearly state "Cocoa flavanols: ≥500 mg per serving" and, ideally, "(−)-epicatechin: ~80 mg." Avoid any label that just says "cocoa extract."

    2. **Look for quality verification —** Seals from third-party testers like USP or NSF International help ensure the product contains what the label claims and has been screened for purity. Brands that share a Certificate of Analysis (COA) from an accredited laboratory.[39]

    3. **Review safety details —** Cocoa plants may absorb cadmium and lead from soil, so choose products tested to meet standards such as California Proposition 65 or USP heavy-metal limits.[40] Cocoa extracts could also contain small amounts of natural stimulants like caffeine and theobromine per serving, so if you're sensitive or already consume other stimulants, choose a decaffeinated option, or better yet, get your flavanols from nutritious foods instead.

- Enjoy an active lifestyle **—** Regular physical activity stimulates the brain to form and strengthen neural connections while promoting the release of brain-derived neurotrophic factor (BDNF), a key protein for cognitive health. Research shows

exercise improves brain structure and function and significantly increases hippocampal volume in older adults with mild cognitive impairment.

- **Skip the banana in your smoothie —** If you're blending berries for their flavanol benefits, adding a banana can dramatically reduce absorption. A study published in Food and Function found that "adding banana to a berry smoothie reduces the flavanols taken in by the consumer by 84%."[41] Professor Gunter Kuhnle of the University of Reading explains:[42]

  "Bananas may be ruled out of the morning smoothie if you want to boost your flavanol intake, but on their own, they are still great fruits." For better results, pair berries with low-enzyme ingredients like pineapple, mango, or yogurt.

Frequently Asked Questions (FAQs) About Flavanols

Q: What are flavanols, and why are they important?

A: Flavanols are plant compounds found in cocoa, tea, berries, apples, and certain legumes and grains, and are known for being poorly absorbed in the bloodstream.

Q: What did the study reveal about the astringent property of flavanols?

A: The study found that the astringent, dry sensation of flavanols signals the brain within minutes. This mouth-first stimulus activated sensory nerves that triggered alertness pathways, leading to sharper learning, improved memory, increased exploratory behavior, and rapid neurotransmitter surges across key brain regions — all of which occurred before digestion even began.

Q: How do flavanols support long-term health?

A: Once metabolized by the gut and circulated as smaller compounds, flavanols help support blood vessel flexibility, reduce oxidative stress, and modulate inflammatory signaling pathways.

Q: What are the best whole-food sources of flavanols?

A: Green tea, berries, apples (with the skin), pears, cherries, cocoa powder, grapes, fava beans, black beans, and grains like millet and buckwheat all provide meaningful amounts. Variety matters — different foods contain different types of flavanols.

Q: Do I need a supplement to get enough flavanols?

A: Not necessarily. Most people meet their needs through a diverse, plant-rich diet. If you choose to use a supplement, look for third-party testing, heavy-metal screening, and clear labeling of stimulant content. Whole foods remain the safest and most balanced long-term source.

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