Cognitive Vitality Reports® are reports written by neuroscientists at the Alzheimer's Drug Discovery Foundation (ADDF). These scientific reports include analysis of drugs, drugs-in-development, drug targets, supplements, nutraceuticals, food/drink, non-pharmacologic interventions, and risk factors. Neuroscientists evaluate the potential benefit (or harm) for brain health, as well as for age-related health concerns that can affect brain health (e.g., cardiovascular diseases, cancers, diabetes/metabolic syndrome). In addition, these reports include evaluation of safety data, from clinical trials if available, and from preclinical models.

Wasabi (6-MSITC)

Evidence Summary

While preclinical data on wasabi/6-MSITC have been positive, very few clinical trials have been completed. Wasabi is likely safe in typical amounts, but large amounts may increase the risk of bleeding.

Neuroprotective Benefit: One clinical trial of older adults reported improved working memory and episodic memory, but not other cognitive functions, with wasabi. Neuroprotective benefits have also been observed in mouse models of AD and PD.

Aging and related health concerns: Only a few small clinical trials have tested the efficacy of 6-MSITC, with mixed findings. In preclinical and cell culture models, wasabi/6-MSITC has shown benefits for cancer and metabolic dysfunction.

Safety: Wasabi is likely safe in amounts typically consumed in food. Large amounts of wasabi may increase the risk of bleeding and bruising in people with bleeding disorders. Based on small, short-term clinical trials, 6-MSITC is well tolerated.

Availability: available as food/condiment	**Dose**: Clinical trials have tested 6-MSITC doses ranging from 0.8 mg/day to up to 9.6 mg/day.	**Chemical formula:** $C_8H_{15}NOS_2$ (6-MSITC) **MW**: 205.3 (6-MSITC)
Half-life: not documented	**BBB**: not documented	
Clinical trials: The largest clinical trial of wasabi enrolled 72 older people to test its effects on cognitive function.	**Observational studies**: none available	

What is it?

Wasabi (*Eutrema japonicum* or *Wasabia japonica*) is a Japanese traditional spice prepared from grinding the plant's rhizome into a paste. Wasabi grows along stream beds in mountain river valleys in Japan. Wasabi is commonly used with raw fish (e.g., sushi and sashimi) to inhibit bacterial growth due to its antimicrobial properties. Wasabi is also used as seasoning of other dishes.

The main bioactive compound of wasabi is 6-methylsulfinylhexyl isothiocyanate (6-MSITC), which has pleiotropic activities, including antioxidant, anti-inflammatory, anti-atherosclerotic, and anti-cancer effects (reviewed in Bartkowiak-Wieczorek et al., 2024). Because of these mechanisms of action, wasabi or 6-MSITC has been tested in preclinical studies of neurodegenerative diseases (Morroni et al., 2014; Morroni et al., 2018), metabolic dysfunction, and cancer (e.g., Fuke et al., 2014; Hsuan et al., 2016). Only a few small clinical trials have tested the efficacy of wasabi/6-MSITC to date.

Neuroprotective Benefit: One clinical trial of older adults reported improved working memory and episodic memory, but not other cognitive functions, with wasabi. Neuroprotective benefits have also been observed in mouse models of AD and PD.

Types of evidence:

- 2 double-blind randomized controlled clinical trials
- 2 open-label trials
- Numerous laboratory studies

Human research to suggest prevention of dementia, prevention of decline, or improved cognitive function:

In a double-blind randomized placebo-controlled trial of 72 healthy older adults over the age of 60, treatment with 6-MSITC (one tablet containing 100 mg wasabi extract powder and 0.8 mg of 6-MSITC; Kinjirushi Co., Ltd, Japan) before bed each night for 12 weeks led to improvement in working memory (measured by digit span backward) and episodic memory (measured by logical memory-immediate, logical memory-delay, and face and second name test) compared to placebo (Nouchi et al., 2023). However, other cognitive functions were not significantly affected, including processing speed, attention, inhibition, reasoning, short-term memory, and visual-spatial performance. There were a total of 12 cognitive outcomes measured in this study, of which 4 were statistically significantly improved with 6-MSITC compared to placebo, after statistical adjustment with the Bonferroni correction.

In a single-arm open-label study of 20 healthy people with daily fatigue, treatment with 6-MSITC (4.8 mg/day; 1.6 mg of 6-MSITC and 200 mg of wasabi extract per capsule; Kinjirushi Co., Ltd) for 4 weeks did not improve fatigue after a mental task, but fatigue before the mental task, sleep, and mood were improved significantly compared to baseline (Nakajima et al., 2023). Because of the open-label study design without a placebo control, placebo effects or practice effects cannot be ruled out.

Myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS) is a debilitating disease characterized by persistent unexplained fatigue that is not improved by rest and is a cause of significant reduction in daily activities. ME/CFS is associated with various symptoms, including myalgia (muscle pain), arthralgia (joint pain), cognitive impairment (e.g., 'brain fog'), and orthostatic intolerance (worsening of symptoms when standing up). ME/CFS can develop suddenly after a viral infection. Pathophysiological mechanisms and effective treatments have yet to be established. In an open-label clinical trial of 15 patients with ME/CFS, treatment with wasabi extract (9.6 mg of 6-MSITC per day; 2 capsules after each meal; Teijin Co., Ltd) for 12 weeks significantly improved subjective symptoms, including the numerical rating scales of brain fog scores (from 5.7 ± 1.6 to 4.5 ± 1.9; p=0.011), difficulty finding appropriate words (from 4.8 ± 2.1 to 3.7 ± 1.7; p=0.015), and the Profile of Mood Status vigor score (from 46.9 ± 8.0 to 50.0 ± 10.7; p=0.045, paired t-test)(Oka et al., 2022). Treatment with 6-MSITC also improved the Trail Making test-A (from 53.0 ± 16.3 sec to 38.1 ± 13.8 sec, p=0.007, paired t-test), suggesting improved frontal lobe brain function. Because of the open-label study design without a placebo control, placebo effects or practice effects cannot be ruled out. There were no significant changes with 6-MSITC treatment on anxiety or depression scores.

Human research to suggest benefits to patients with dementia:

No studies have tested the efficacy of wasabi or 6-MSITC in patients with dementia.

Mechanisms of action for neuroprotection identified from laboratory and clinical research:

Mouse model of Alzheimer's disease: In a mouse model of Alzheimer's disease (intracerebroventricular injection of Aβ oligomers), 6-MSITC treatment (5 mg/kg, i.p.) started 1 hour after injection of Aβ oligomers and continued for the next 10 days resulted in attenuation of spatial memory impairment (measured by the Morris water maze) and short-term memory impairment (measured by passive avoidance), a reduction of neuronal loss and injury in the hippocampal CA1, a reduction of reactive oxygen species in the hippocampus, as well as an increase in the anti-oxidant glutathione levels compared to vehicle treatment (Morroni et al., 2018). Additionally, 6-MSITC treatment inhibited the activation of apoptosis (caspase-9 and caspase-3), inflammation in the hippocampus (microglial activation, astrocytic activation), and phosphorylation of ERK and GSK3.

Mouse model of Parkinson's disease: In a mouse model of Parkinson's disease (induced by 6-OHDA injection into the striatum), treatment with 6-MSITC (5mg/kg twice a week) for 4 weeks ameliorated rotational behavior, restored motor coordination (measured by rotarod), preserved dopaminergic neurons in the substantia nigra (by 46%; $p<0.01$), blocked DNA fragmentation, blocked the apoptotic caspase-3 activation, and promoted the glutathione-dependent antioxidant activities (measured by GSH, GST, and GR), compared to vehicle treatment (Morroni et al., 2014).

Cell culture models: In cell culture (HepG2 cells), 6-MSITC increased the expression of the antioxidant transcription factor, Nrf2, as well as extended the half-life of the Nrf2 protein by 3-fold (Hou et al., 2011).

In neuronal cell culture (SH-SY5Y neurons), 6-MSITC treatment increased protein and mRNA levels of ADAM17, an enzyme that cleaves amyloid precursor protein within the Aβ sequence (preventing the formation of Aβ), in an Nrf2-dependent manner (Carnicero-Senabre et al., 2025). In this neuronal culture, 6-MSITC induced the non-amyloidogenic pathway.

APOE4 interactions:

No studies have explored whether the efficacy of wasabi or 6-MSITC is different based on APOE genotype.

Aging and related health concerns: Only a few small clinical trials have tested the efficacy of 6-MSITC, with mixed findings. In preclinical and cell culture models, wasabi/6-MSITC has shown benefits for cancer and metabolic dysfunction.

Types of evidence:

- 2 double-blind randomized controlled clinical trials
- 2 open-label trials
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Strength/Fatigue: LACK OF BENEFIT

In a double-blind randomized controlled crossover study of 8 healthy young males, treatment with 6-MSITC (9 mg/day; 3 mg with each meal; Wasabi no Iyashi; Kobe Wellness Science Corporation, Hyogo, Japan) started one day before high-intensity and repeated exercise (30 maximal isokinetic, 120°/s, eccentric elbow flexor contractions) and continued for 4 days did not significantly alter muscle damage markers or inflammatory biomarkers (MVC torque, ROM, muscle soreness, T2, serum CK activity, and U-titin concentration) relative to placebo (Tanabe et al., 2022). There were also no effects of 6-MSITC treatment on plasma levels of calpain-1, an enzyme that is involved in muscle remodeling and protein degradation; however, calpain-1 is ubiquitously expressed throughout the body and the measured calpain-1 levels may not have reflected that in skeletal muscles.

In an open-label clinical trial of 15 patients with myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS), treatment with 6-MSITC (9.6 mg of 6-MSITC per day; 2 capsules after each meal; Teijin Co., Ltd) for 12 weeks significantly improved performance status (from 6.8 ± 1.7 to 6.3 ± 2.1, p=0.014, paired t-test), general health perception (measured by the SF-36 subscale; from 33.4 ± 6.2 to 36.8 ± 8.1; p=0.036), and vitality scores (from 32.7 ± 7.9 to 35.7 ± 9.0, p=0.039) compared to baseline, but the scores on the 11-item Chalder Fatigue scale (CFS-11) and numerical rating scale of fatigue did not show significant changes compared to baseline (Oka et al., 2022). Specifically, the CFS-11 physical fatigue (from 13.9 ± 4.2 to 14.1 ± 3.3), mental fatigue (from 8.1 ± 3.9 to 6.4 ± 1.8), and total scores (from 22.0 ± 6.2 to 20.5 ± 4.5) did not show significant changes after treatment (p>0.05 for all). Some subjective symptoms were improved with the 6-MSITC treatment, including headache frequency (from

4.1 to 3.0 times/week, p=0.001) and myalgia (from 4.1 to 2.4 times/week, p=0.019). Pressured pain threshold of the right occiput also increased (from 17.3 ± 10.6 to 21.3 ± 10.6 kPa, p=0.01), suggesting reduced pain sensitivity. Because of the open-label study design without a placebo control, placebo effects cannot be ruled out.

Cancer: BENEFIT IN RODENT AND CELL CULTURE MODELS

In a mouse model of breast cancer (Balb-nu/nu mice with MDA-MB-231 or -453 cells), 6-MSITC treatment (6.25, 25, or 100 mg/kg, in deionized water, orally, 5 days/week) for 12 days significantly inhibited tumor growth, measured by tumor volumes and tumor weights (Fuke et al., 2014). In vitro studies (MDA-MB-231, MDA-MB-453, and MCF-7 cells) also showed that 6-MSITC treatment induced apoptosis (measured by DNA fragmentation and caspase 3/7 activity). In MDA-MB-231 and MDA-MB-453 cells (but not in MCF-7 cells), 6-MSITC downregulated the pro-inflammatory NF-κB expression in a concentration-dependent manner. Together, 6-MSITC promoted apoptosis of breast cancer cells by inhibiting NF-kB.

In a mouse model of colon cancer (BALB/c nude mice with tumor xenograft formed by Colo 205 cells), wasabi extract treatment (250 mg/kg by oral gavage, 5 days/week) for 42 days delayed tumor growth (Hsuan et al., 2016). In tumor tissue, wasabi extract induced apoptosis and mitochondrial death machinery (through the activation of TNF-α, Fas-L, caspases, truncated Bid and cytochrome C) and promoted autophagy (by decreasing the phosphorylation of Akt and mTOR). The dose used in this study in mice, when accounting for body surface area, is equivalent to 2 grams of wasabi extract in a human weighing 70 kg, which is equivalent to 40 grams of fresh wasabi.

In cell culture studies of colorectal cancer (two types of human colorectal cancer cells, HCT116 p53+/+ and HCT116 p53-/-), 6-MSITC treatment (provided by Kinjirushi, Nagoya, Japan) inhibited cancer cell proliferation in a dose-dependent manner, while increasing the ratio of proapoptotic cells (Yano et al., 2018). Studies in mitochondria found that 6-MSITC treatment caused mitochondrial membrane potential loss, cytochrome c release, and caspase-3 and -8 activation in both types of cells, leading to cancer cell apoptosis (in a p53-independent mitochondrial dysfunction pathway).

In cell culture studies of human pancreatic cancer (PANC-1 and BxPC-3 cell lines), 6-MSITC treatment inhibited the viability of pancreatic cancer cells in a dose- and time-dependent manner by promoting mitosis arrest and apoptosis (Chen et al., 2014).

In cell culture studies of human oral cancer (SAS and OECM-1 cells), 6-MSITC treatment inhibited the viability of oral cancer cells by promoting mitotic arrest and apoptosis (Lee et al., 2018). Chemical derivatives of 6-MSITC, I7447 (sulfide containing no oxygen) and I7557 (sulfone containing 2 oxygens) had greater anti-cancer effects than 6-MSITC.

Sleep: MIXED

In a single-arm open-label study of 20 healthy people with daily fatigue, treatment with 6-MSITC (4.8 mg/day; 1.6 mg of 6-MSITC and 200 mg of wasabi extract per capsule; Kinjirushi Co., Ltd) for 4 weeks significantly improved some visual analog scales of sleep, including "quality of sleep" and "sleepiness of rising", but not others (e.g., "ease of falling asleep")(Nakajima et al., 2023). Because of the open-label study design without a placebo control, placebo effects cannot be ruled out.

In an open-label clinical trial of 15 patients with myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS), treatment with 6-MSITC (9.6 mg of 6-MSITC per day; 2 capsules after each meal; Teijin Co., Ltd) for 12 weeks did not significantly improve sleep quality (measured by the mean Pittsburgh Sleep Quality Index) compared to baseline (Oka et al., 2022).

Blood pressure: NO CHANGE

In an open-label clinical trial of 15 patients with myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS), treatment with 6-MSITC (9.6 mg of 6-MSITC per day; 2 capsules after each meal; Teijin Co., Ltd) for 12 weeks did not significantly change systolic blood pressure, diastolic blood pressure, or heart rate (Oka et al., 2022).

In a rat model of metabolic syndrome (induced by a high-carbohydrate, high-fat diet), treatment with wasabi (5% w/w wasabi powder in the diet) for 8 weeks significantly reduced systolic blood pressure (Thomas et al., 2022).

Hyperlipidemia and metabolic dysfunction: BENEFIT IN RODENTS

In a rat model of metabolic syndrome (induced by a high-carbohydrate, high-fat diet), treatment with wasabi (5% w/w wasabi powder in the diet) for 8 weeks significantly reduced body weight, fat mass, plasma triglycerides, total cholesterol, and blood glucose levels (Thomas et al., 2022). Wasabi in the diet decreased retroperitoneal, epididymal, omental and total abdominal fat in high-carb/fat diet-fed rats.

Safety: Wasabi is likely safe in amounts typically consumed in food. Large amounts of wasabi may increase the risk of bleeding and bruising in people with bleeding disorders. Based on small, short-term clinical trials, 6-MSITC is well tolerated.

Types of evidence:

- 3 double-blind randomized controlled trial
- 2 open-label trials
- Numerous laboratory studies

Wasabi is consumed as food/condiment/seasoning and is generally safe in amounts typically consumed in food. Large amounts of wasabi, however, might increase the risk of bleeding and bruising in people with bleeding disorders (WebMD.com). Wasabi might also slow blood clotting, so it may increase bleeding during surgery. It is recommended that large amounts of wasabi is avoided at least 2 weeks before surgery.

Safety findings from clinical trials: A double-blind randomized placebo-controlled trial evaluating the safety of high-dose 6-MSITC tested a dose of up to 16 mg/day (extracted from wasabi) for 4 weeks in 30 healthy volunteers (Nakajima et al., 2023). There were no serious adverse events, nor were there any problematic findings in the medical interviews. There were 8 adverse events observed during the study period, and all were judged by the investigator to be unrelated to the wasabi extract. There were no significant changes observed for body weight or urinalysis results. Hematological tests showed significant changes in MCH, neutrophils/white blood cell images, lymphocytes/white blood cell images, and monocytes/white blood cell images; however, the investigator judged that there were no safety problems because all values were within the reference values.

In a double-blind randomized controlled crossover study of 8 healthy young males, treatment with 6-MSITC (9 mg/day; 3 mg with each meal; Wasabi no Iyashi; Kobe Wellness Science Corporation, Hyogo, Japan) started one day before high-intensity and repeated exercise (30 maximal isokinetic, 120°/s, eccentric elbow flexor contractions) and continued for 4 days did not result in any side effects associated with 6-MSITC intake throughout the study (Tanabe et al., 2022). The authors also discuss their pilot work that demonstrated that 10 mg/day of 6-MSITC had no measurable influence on urine or blood variables, including lipid and glucose metabolism, liver, kidney, and pancreatic functions, and electrolytes.

In a single-arm open-label study of 20 healthy people with daily fatigue, treatment with 6-MSITC (4.8 mg/day; 1.6 mg of 6-MSITC and 200 mg of wasabi extract per capsule; Kinjirushi Co., Ltd) for 4 weeks did not result in any significant adverse events, medical interventions, subjective or objective symptoms, or changes in BMI (Nakajima et al., 2023). There were 5 adverse events during the study period, but the investigator judged there was no causal relationship between the adverse event and the wasabi extract. Adverse events included 2 cases of shoulder stiffness, 1 pain of left-hand thumb, 1 pain of left upper arm, neck and shoulder, and 1 COVID-19

In an open-label clinical trial of 15 patients with myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS), treatment with 6-MSITC (9.6 mg of 6-MSITC per day; 2 capsules after each meal; Teijin Co., Ltd) for 12 weeks did not result in any serious adverse reactions (Oka et al., 2022).

Other safety findings:

There was an incident of Takotsubo cardiomyopathy in a 60-year-old woman who consumed a substantial amount of wasabi (discussed in a review by Bartkowiak-Wieczorek et al., 2024). It was hypothesized that the cardiomyopathy was a stress-induced reaction. The patient had no history of heart disease or other significant illness.

Drug interactions: Because wasabi might slow blood clotting, it may interact with anti-coagulant and antiplatelet drugs. Taking large amounts of wasabi while taking anticoagulants or antiplatelet drugs may increase the risk of bruising and bleeding.

Sources and dosing:

Wasabi is available as a food condiment and is typically in paste or powder form. It is worth noting that most wasabi packets and wasabi powder sold in the US do not contain real wasabi—they typically contain horseradish or other types of radishes or mustard with artificial green color added.

Clinical trials have tested 6-MSITC doses ranging from 0.8 mg/day (from 100 mg of wasabi extract powder) (Nouchi et al., 2023) to up to 9.6 mg/day (Oka et al., 2022).

Research underway:

No clinical trials testing wasabi or 6-MSITC are ongoing as of June 2025, based on ClinicalTrials.gov.

Search terms:

Pubmed, Google: wasabi, 6-MSITC

Websites visited for wasabi, 6-MSITC:

- Clinicaltrials.gov
- NIH RePORTER (0)
- WebMD.com
- Examine.com
- DrugAge (0)
- PubChem
- DrugBank.ca (0)
- Labdoor.com (0)