Citrus Fruits FOR BRAIN HEALTH

Brain health is moving to the forefront of dietary recommendations

- ✓ Depression and dementia now leading causes of disease burden[1].
- ✓ Diet an established determinant of brain health[2].
- ✓ Better brain health not only reduces chronic disease risk, it also means improved mental health and everyday performance[2].

COMMON BRAIN HEALTH MEASURES IN SCIENTIFIC STUDIES:

Cognitive function or performance:
High-level thinking such as attention, memory, decision-making, and judgment.

Measured over: SHORT TO MEDIUM TERM

Depression:
Depressed mood, diminished interests, and impaired cognitive function.

Measured over: MEDIUM TO LONG TERM

Cognitive decline:
Loss of memory or other cognitive functions in older age. Significant cognitive decline can result in dementia.

Measured over: LONG TERM

THE EVIDENCE: citrus fruits benefit brain health outcomes over time

COGNITIVE FUNCTION

In randomised controlled trials, flavonoid-rich orange juice improves cognitive performance in healthy adults[3,4].

- AFTER 2 HOURS: Greater psychomotor speed after consuming 240 mL **orange juice**.
- AFTER 6 HOURS: Improved executive function and subjective alertness after consuming 240 mL **orange juice**.
- AFTER 8 WEEKS: Improved global cognitive function in older adults after consuming 500 mL **orange juice** daily.

DEPRESSION

AFTER 10 YEARS

In a prospective analysis of US female nurses, citrus fruits and citrus juices had a lower risk of depression[6]:

18% reduced depression risk with 2 or more servings of **citrus fruits or juices** daily.

DEMENTIA

AFTER 6 YEARS

In a prospective cohort study, citrus fruits was associated with reduced dementia incidence[5]:

18% reduced risk for citrus 3-4 times a week, and 23% reduced risk for **citrus** daily.

COGNITIVE DECLINE

In recent analyses of large prospective cohorts of US health professionals, citrus fruits and their juices was associated with better cognitive function in older age[7,8].

- AFTER 18-22 YEARS: In a 2019 analysis of the Health Professionals' Follow-Up Study cohort, **orange juice** reduced the odds of poor subjective cognitive function by 47%[7].
- UP TO 30 YEARS: In a 2021 analysis of the Nurses' Health Study and Health Professionals' Follow-Up Study, higher intake of **oranges, grapefruit, and citrus juices** were associated with better cognitive function[8].

Prospective cohort study = an observational study that is considered to provide the greatest level of evidence relative to the other observational study designs.

Randomised controlled trial = an experimental study considered to provide the most reliable evidence on the effectiveness of interventions.

In a cross-sectional study of over 2000 older adults, citrus fruits had one of the strongest positive associations with cognitive performance **of all plant foods**[9].

Citrus fruits are a unique, whole food package

All citrus fruits contain: **Flavonoids**, **vitamin C** and **fibre**.
It is this unique, whole food package that is thought to benefit brain health.

FLAVONOIDS[9-12]

- ✓ A major class of polyphenols.
- ✓ Citrus fruits are one of the richest sources of flavonoids. Some flavonoids, such as hesperidin and naringenin, are specific to citrus fruits.
- ✓ High flavonoid intake associated with reduced risk of depression and reduced cognitive decline in cohort studies, and improved cognitive function in experimental trials.

VITAMIN C

- ✓ One serve (~150 grams) of citrus fruits can provide up to 173% of the Recommended Daily Intake of vitamin C[13,14].
- ✓ Vitamin C associated with improved brain outcomes including reduced risk of dementia[15].

FIBRE

- ✓ Citrus fruits have a balance of soluble and insoluble fibre, including prebiotic fibres[16].
- ✓ Fibre, particularly soluble fibre, has been associated with reduced risk of dementia[15].

How can citrus fruits improve brain health?

Exact mechanisms for how citrus fruits could improve brain health are not fully understood.
Potential mechanisms[10,17,18] include:

PREBIOTIC

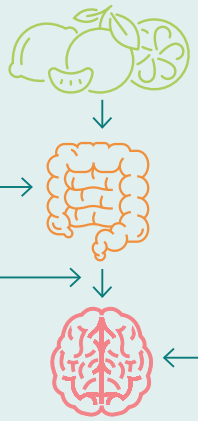
Both **flavonoids**[19] and **soluble fibres**[16] have prebiotic effects, feeding the gut microbiota and increasing the production of short chain fatty acids.

Flavonoids are broken down by the gut bacteria into smaller functional compounds that are more bioavailable[3].

GUT-BRAIN AXIS

Flavonoids and **short chain fatty acids** can cross the blood brain barrier. Some flavonoids, such as naringenin, localise in the brain[20].

Flavonoids also increase blood flow to the brain[4].



NEUROPROTECTIVE

Flavonoids have direct neuroprotective effects in the brain, including antioxidant activity, reducing neuroinflammation, and increasing helpful proteins and signaling pathways (e.g., brain-derived neurotrophic factor)[3].

Vitamin C and **short-chain fatty acids** help to reduce oxidative stress and neuroinflammation, respectively, which are key contributing factors to brain disorders[21,22].

Take home messages:

1. Brain health benefits start with having citrus fruits 3-4 times per week. Citrus fruits can be consumed as whole, peel, and juice.
2. Citrus fruits are a key part of evidenced-based dietary recommendations for brain health.
3. Citrus fruits fit within minimally processed, plant-based and Mediterranean-style diets.

1 SERVE CITRUS = ~ 150 GRAMS =

- 1 orange
- 2 mandarins
- 1 lemon
- 2 limes
- ½ grapefruit
- ½ cup 100% citrus juice

References:

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SCAN FOR MORE INFO

This brochure is intended for educational purposes only.

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