

FOODiQ
global

**A *new* narrative for
communicating
citrus health
benefits**



**Hort
Innovation**

**CITRUS
FUND**



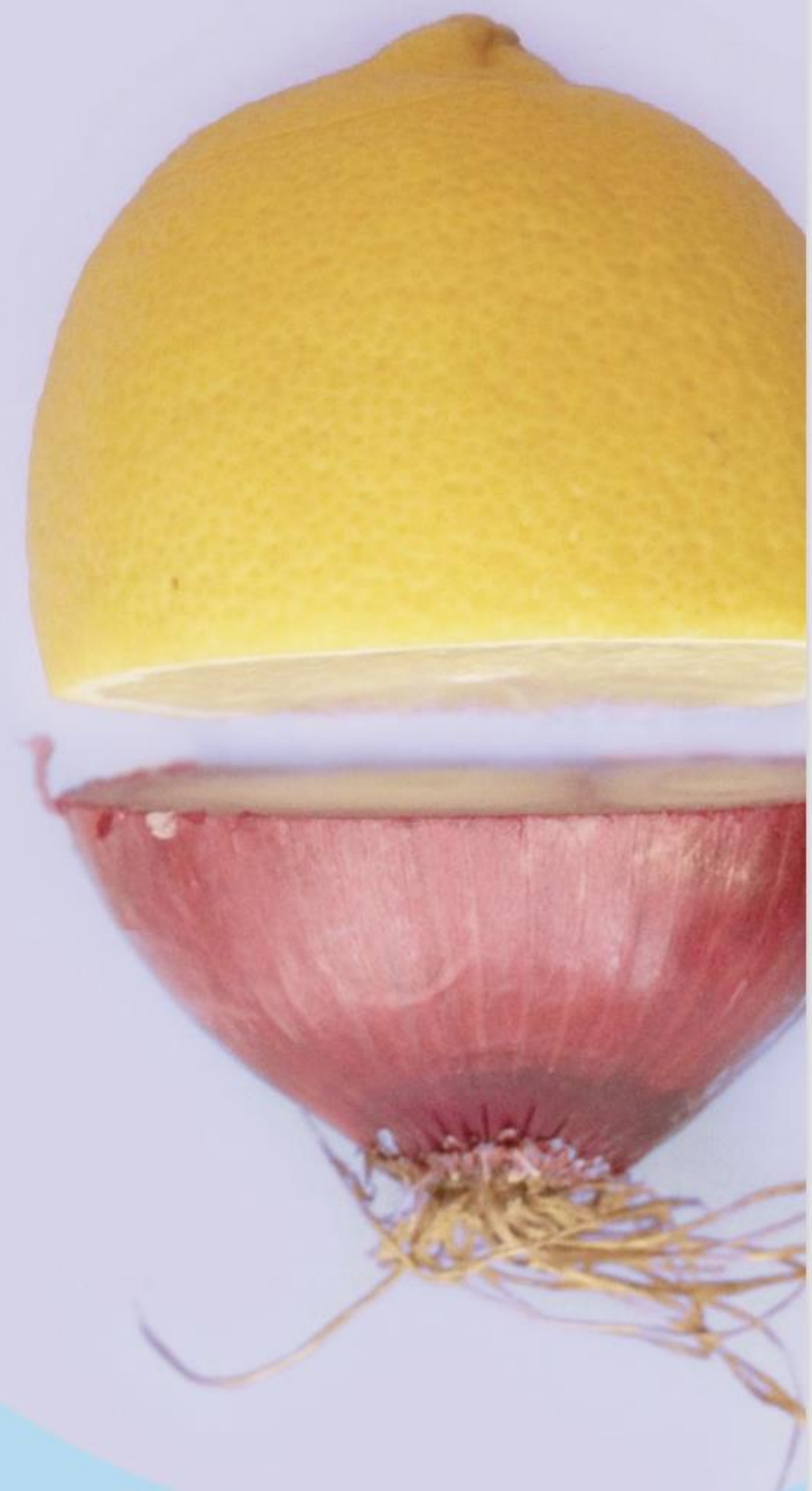


Serious
about citrus





Why educate healthcare professionals?



Citrus & health are misunderstood



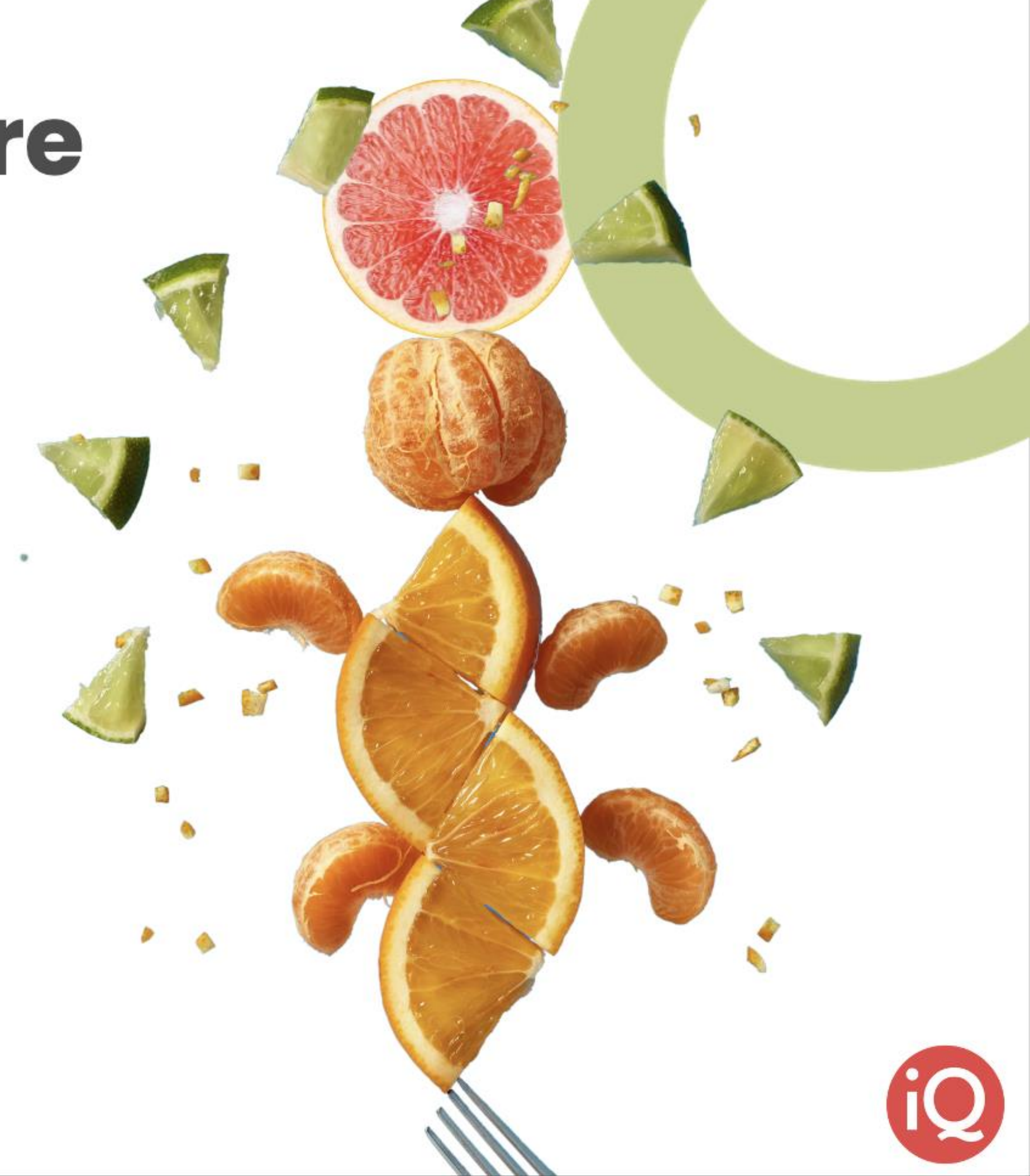
Update



Educate



Empower



New narratives needed



Not top of mind – so many fruits, why citrus?



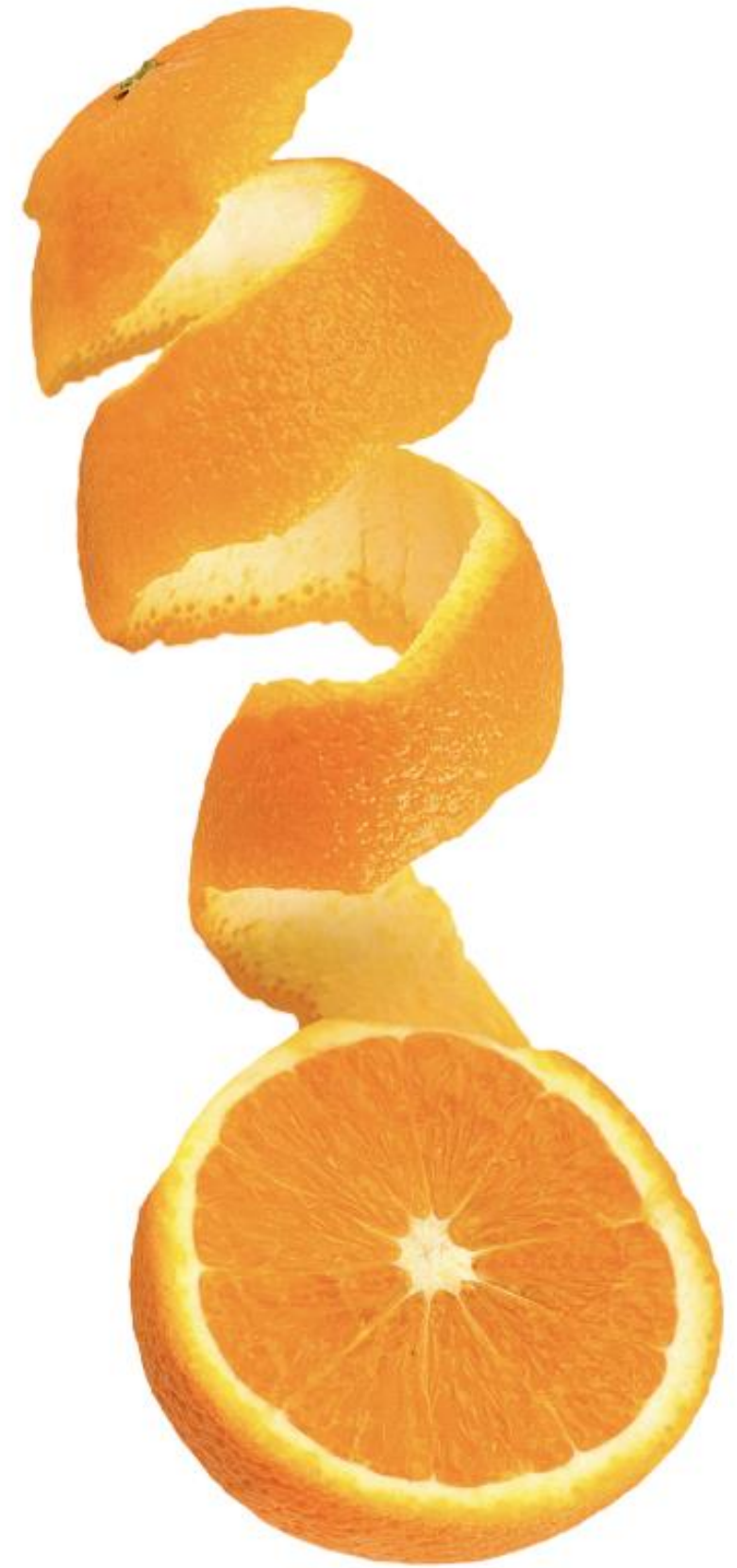
Vitamin C – Half could identify some nutritional properties, focus was vitamin C.



Disconnect – between science, recommendations & practice.



Out of date – lack of modern information.



Reframing citrus

OLD PARADIGM:

Vitamin C = prevents deficiency



NEW PARADIGM:

Unique food matrix = Systemic health benefits

Need **specific** stories to stick



Generally
good

Vs.



Specifically
good



Citrus as a forgotten, affordable **superfood**



Affordable



Familiar



Accessible



Easy



Nutrient
dense



Bioactive
rich



Citrus has important, specific **benefits**

Citrus Fruits FOR BRAIN HEALTH

Brain health is moving to the forefront of dietary recommendations

- ✓ Depression and dementia now leading causes of disease burden¹.
- ✓ Diet an established determinant of brain health².
- ✓ Better brain health not only reduces chronic disease risk, it also means improved mental health and everyday performance³.

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^{4,5}.

→ **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 In a prospective analysis of US female nurses, citrus fruits and citrus juices had a lower risk of depression⁶.

→ **AFTER 10 YEARS** 18% reduced depression risk with 2 or more servings of citrus fruits or juices daily.

DEMENTIA In a prospective cohort study, citrus fruits was associated with reduced dementia incidence⁷.

→ **AFTER 6 YEARS** 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^{8,9}.

→ **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%⁸.

→ **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 function⁹.

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 foods¹⁰.

Citrus Fruits FOR IMMUNITY

As new infectious challenges emerge and cold and flu viruses continue to circulate widely¹, interest in foods for immunity is strong.

Citrus is commonly believed to support immunity... but is it an evidence-based recommendation?

IMMUNITY RECAP
A healthy immune system is a balance of protective inflammation and anti-inflammatory pathways utilising antioxidants to prevent damage and support microbiomes. For both acute and chronic illness, this complex balancing act requires nutritional support² for optimal barrier, detection, targeting, elimination, and memory function.

CITRUS FRUITS are a unique nutrition package for immune support

CITRUS IS NOTABLE FOR VITAMIN C WHICH IS WELL-ESTABLISHED IN SUPPORTING IMMUNITY

Vitamin C improves immune outcomes in meta-analyses

31 RCTs ^{3,4}	3 RCTs ⁵	24 RCTs ⁶	5 RCTs ⁷
Reduces duration and severity of common colds.	Reduces risk and duration of pneumonia.	No effect on common cold incidence generally.	Decreased infection in short-term, high physical stress.

Vitamin C is vital to:

- ✦ barrier function & wound healing via collagen promotion⁸.
- ✦ chemotaxis to recruit cells to targets⁹.
- ✦ function of white blood cells¹⁰.
- ✦ antioxidant and anti-inflammatory activity¹¹.

EMERGING SCIENCE SHOWS CITRUS BIOACTIVES SUPPORT IMMUNITY

Bioactive citrus flavonoids are in all parts of the fruit¹².

Key citrus flavonones are not commonly found in other fruits¹³.

Bioactive citrus flavonoids support immunity in 3 ways

- 1 Anti-microbial**
 - Hesperidin and hesperitin: reduce binding and replication of SARS-CoV-2, and free radical damage^{14,15}.
 - Hesperidin, hesperitin and quercetin: prevent influenza replication¹⁶.
- 2 Antioxidant^{17,18}**
 - Enhance activity of human antioxidant enzymes, and inhibit pro-oxidant enzymes.
 - Absorb and neutralise free-radicals.
 - Hesperidin, naringenin and orange juice: reduced reactive oxygen species in RCTs¹⁹.
- 3 Anti-inflammatory**
 - Hesperidin and orange juice: reduced inflammatory markers in humans²⁰.
 - Naringenin, naringin and narirutin: anti-inflammatory effects (cells & animals)²¹.
 - Hesperidin and naringin: increased microbiome short chain fatty acids (SCFA) production, particularly immune modulating propionate²².

Major Citrus Flavonoids^{12,13}

- Hesperidin
- Hesperitin
- Narirutin
- Naringenin
- Diosmin
- Nobiletin
- Quercetin

CITRUS FRUITS HAVE A UNIQUE FIBRE PROFILE

DIETARY FIBRES HAVE DIRECT AND INDIRECT IMPACTS ON THE IMMUNE SYSTEM.

- ✓ Soluble fibres (eg. pectins) abundant in citrus support gastrointestinal barrier function²³ and feed the microbiome to support the gut-immunity axis²⁴.
- ✓ Citrus peel dietary fibres: contain monosaccharides (arabinose, rhamnose, xylose)²⁵ that increase anti-inflammatory SCFAs²⁶.

FIBRE

- MOST FRUITS & VEGETABLES = PREDOMINATELY INSOLUBLE FIBRE
- CITRUS FRUITS = A BLEND OF SOLUBLE (PREBIOTIC) & INSOLUBLE²⁷

Citrus Fruits FOR HEART HEALTH

Heart health is still the most pressing health concern in Australia.

Heart disease is the #1 cause of death in Australia¹.

- One death every 18 minutes and one hospitalisation every 80 seconds.
- Diet a widely established modifiable risk factor for heart disease.

COMMON HEART HEALTH MEASURES IN SCIENTIFIC STUDIES:

- Markers of cardiovascular disease (CVD) risk:** Biomarkers that increase CVD risk such as high blood pressure (BP) and lipids. Measured over: SHORT TO MEDIUM TERM
- Cardiovascular disease:** Diseases of the heart and blood vessels that includes coronary heart disease (CHD) and stroke. Measured over: LONG TERM
- CVD mortality:** Death with CVD as the underlying cause. Measured over: LONG TERM

THE EVIDENCE: Citrus fruits benefit heart health outcomes

CVD MARKERS

- In meta-analysis of randomised controlled trials, citrus fruits and citrus juices improve markers of CVD².
- 2.1% FMD improvement in flow-mediated dilation (FMD) in a meta-analysis of 35 randomised control trials (RCTs) for fruit juices (including citrus) vs. control.
- 3.1 mmHg SBP reduction in systolic blood pressure (SBP) in a meta-analysis of 35 RCTs for fruit juices (including citrus) vs. control.
- 2.4 mmHg SBP reduction in SBP in a meta-analysis of 3 RCTs for grapefruit vs control.

CVD

In large prospective cohorts of US health professionals, higher intake of citrus fruits and their juices was associated with reduced CVD risk³.

- 19% RR Reduced risk (RR) of ischaemic stroke for citrus fruits and their juices.
- 25% RR Reduced risk of ischaemic stroke for citrus juices alone.

CVD MORTALITY

In a large prospective cohort study of US women⁴:

- 15% RR Reduced risk of CHD mortality with grapefruit consumption.





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 the Nurses' Health Study and the Health Professionals' Follow-Up Study, citrus fruits (including juice) had one of the strongest protective associations for ischaemic stroke of all fruit and vegetable types⁵.

More to 'C' IN CITRUS

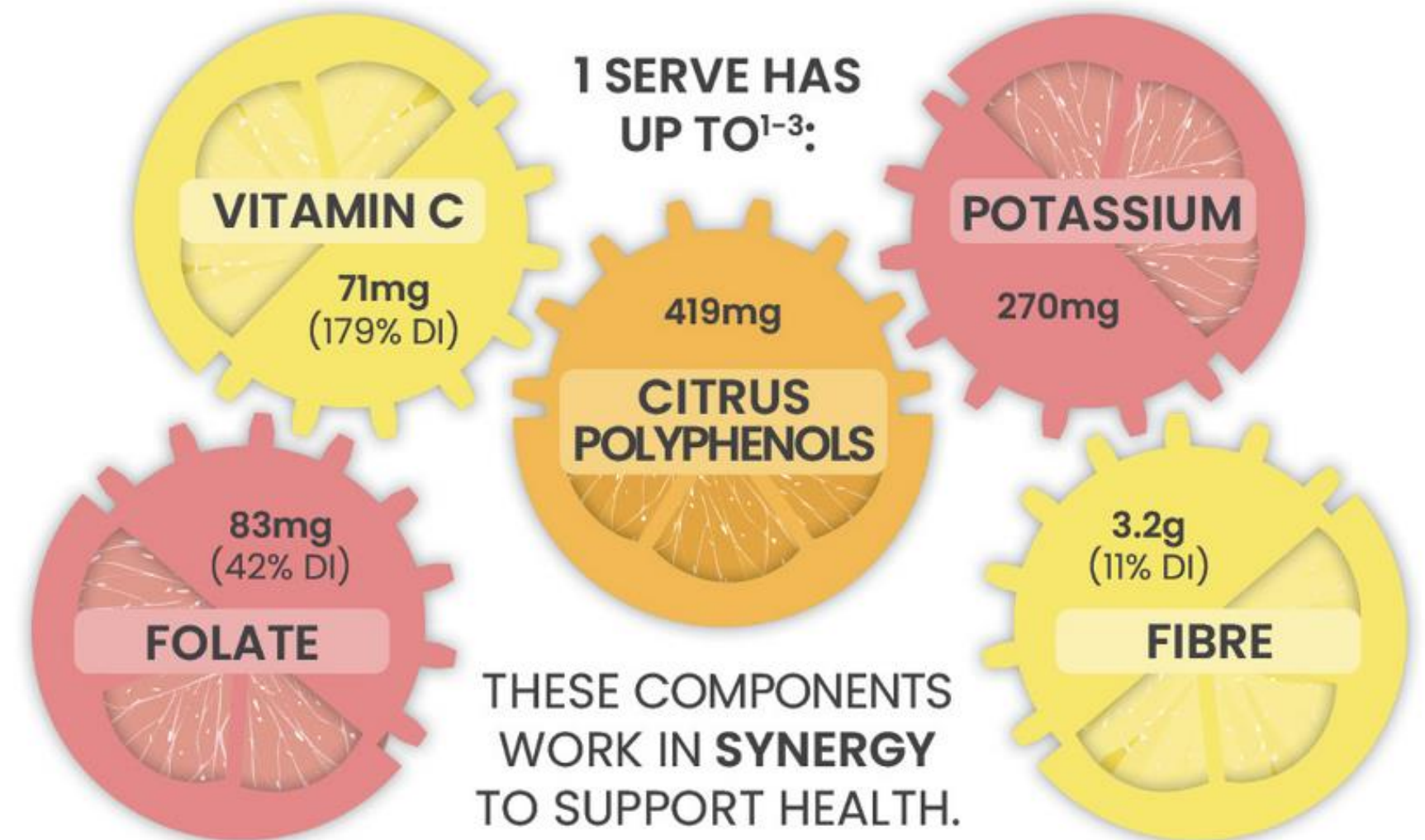
Long known for their vitamin C content, modern nutritional research shows there is much more to citrus fruits than just vitamin C.

The many
HEALTH BENEFITS OF CITRUS

 HEART: 19% reduced risk of heart disease ¹ .	 BRAIN: 18% reduced risk of dementia ² .
 GUT: Improved gut microbiota composition ³ .	 MOOD: 18% reduced risk of depression ⁴ .

THE NUTRIENTS IN CITRUS ARE ALSO IMPORTANT FOR IMMUNITY⁵.

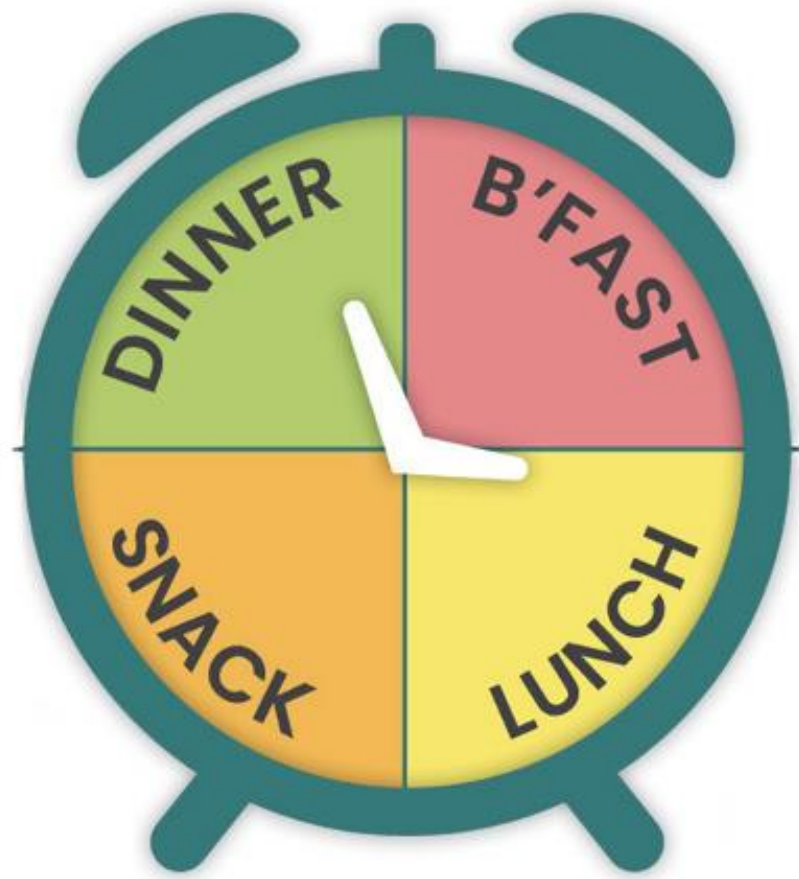
1. Joshipura (1999) <https://doi.org/10.1001/jama.282.13.1233>. 2. Zhang (2017) <https://doi.org/10.1017/S000711451700109X>. 3. Fidelix (2020) <https://doi.org/10.3039/c9fo02623a>. 4. Chang (2016) <https://doi.org/10.3945/ajcn.115.1245-45>. 5. Hemila (2013) <https://doi.org/10.1002/14651958.CD000980.pub4>



DI = Daily Intake. 1 serve = ~ 150 g

1. Australia New Zealand Food Standards Code – Schedule 1 – RDIs and ESADDIs <https://www.legislation.gov.au/Series/F2015L00491>. 2. Australian Food Composition Database (2022). 3. <http://phenol-explorer.eu/>

Citrus for culinary **inspiration**



<p>WHOLE AS A SNACK</p>	<p>SLICES IN WATER OR TEA</p>	<p>AS JUICE</p>
<p>GRILLED ADDED TO MEALS</p>	<p>FREEZE JUICE AS ICE BLOCKS</p>	<p>ADD LEMON JUICE & ZEST TO YOUR FAVOURITE SOUPS</p>
<p>USE LEMON OR LIME JUICE & ZEST TO CURE SEAFOOD OR BEEF</p>	<p>IN SALAD DRESSINGS</p>	<p>SLICE SEGMENTS INTO SALADS</p>

Savouring citrus:
FRESH & VIBRANT RECIPE INSPIRATIONS

Citrus fits healthy **dietary patterns**



- DASH-diet
- Mediterranean diet
- Plant-based/vegetarian
- Minimally processed

The whole fruit is edible & nutritious



100% citrus juice is **misunderstood**

What is a serve of fruit?

A standard serve is about 150g (350kJ) or:

- 1 medium apple, banana, orange or pear
- 2 small apricots, kiwi fruits or plums
- 1 cup diced or canned fruit (no added sugar)

Or only occasionally:

- 125ml (½ cup) fruit juice (no added sugar)
- 30g dried fruit (for example, 4 dried apricot halves, 1½ tablespoons of sultanas)



Most Australians eat only about half the recommended quantity of fruit. However many of us drink far too much fruit juice. Fruit juices can be high in energy (kilojoules) and low in dietary fibre, and can even damage your teeth. Whole fruits are a much better choice, and are more filling.



Updating the evidence for 100% juice & health



20%

Benefits

- CVD markers (SBP, DBP, Uric acid, FMD)
- IL-6, CRP
- Stroke

76%

No effect

- Adults & Children
-
- Breast & colorectal

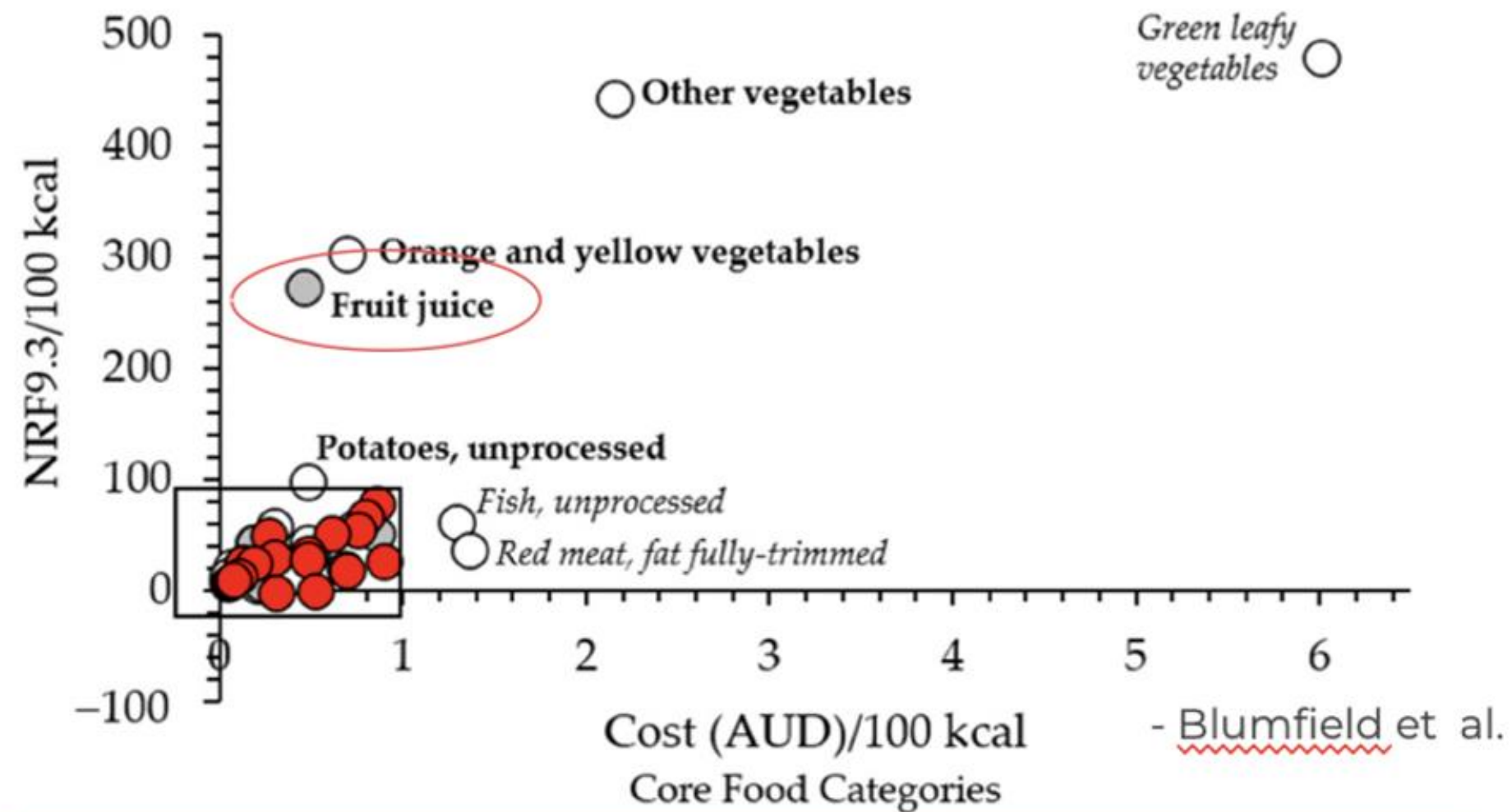
6%

Risks

- T2DM
RR: 01.07 (1.01 – 1.14)
- Prostate cancer
RR: 01.03 (1.01 – 1.05)
- CVD mortality
HR: 1.2 (1.01 – 1.42)

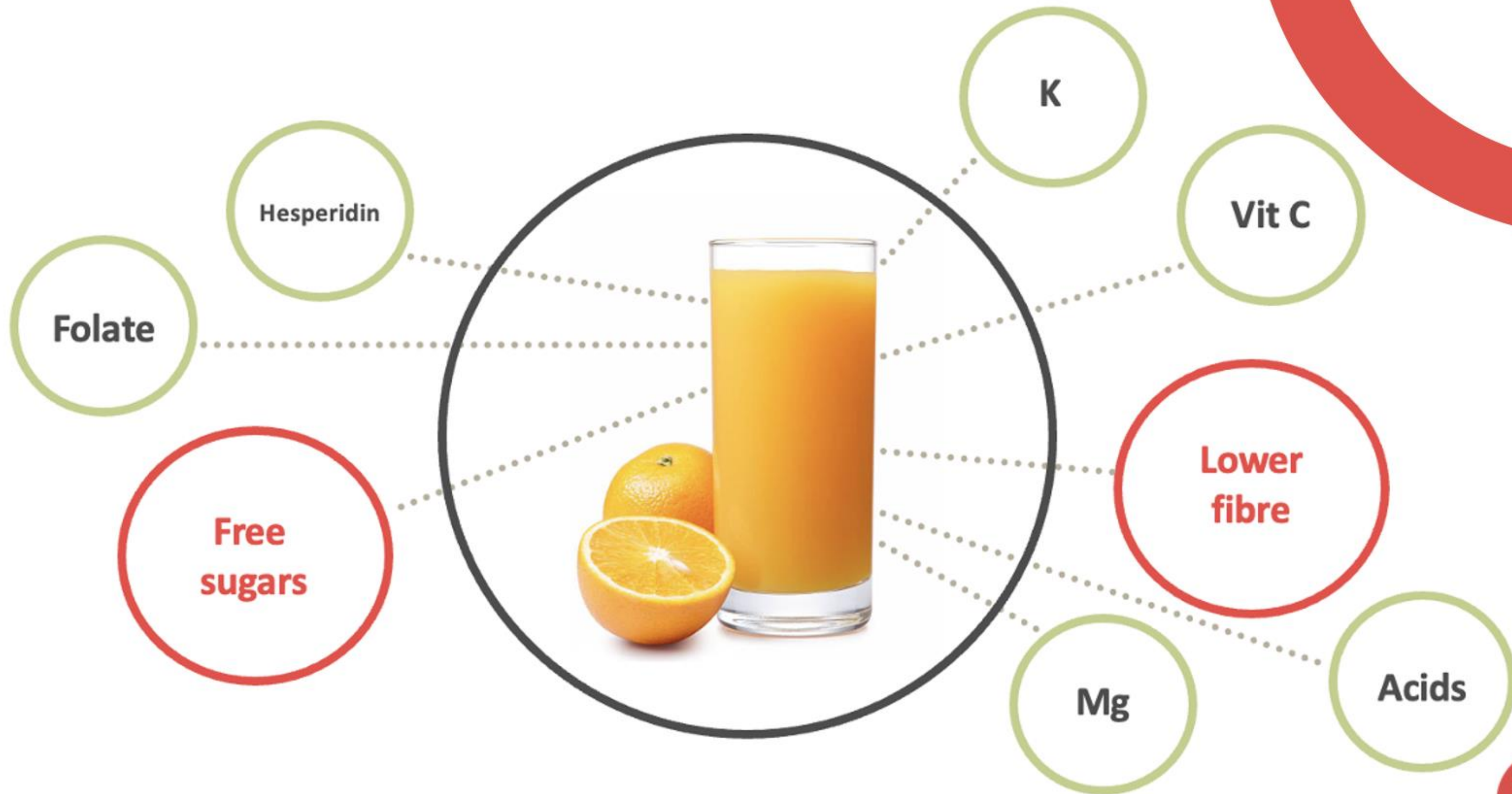
No eligible evidence for harm to teeth





“The preponderance of evidence supports the position that 100% fruit juice delivers essential nutrients and phytochemicals, provides year-round access to a variety of fruits, and is a cost-effective way to help people meet fruit recommendations”.

- Clemens et al. 2015



New narratives



Sticky stories – top of mind for KOLs & professionals



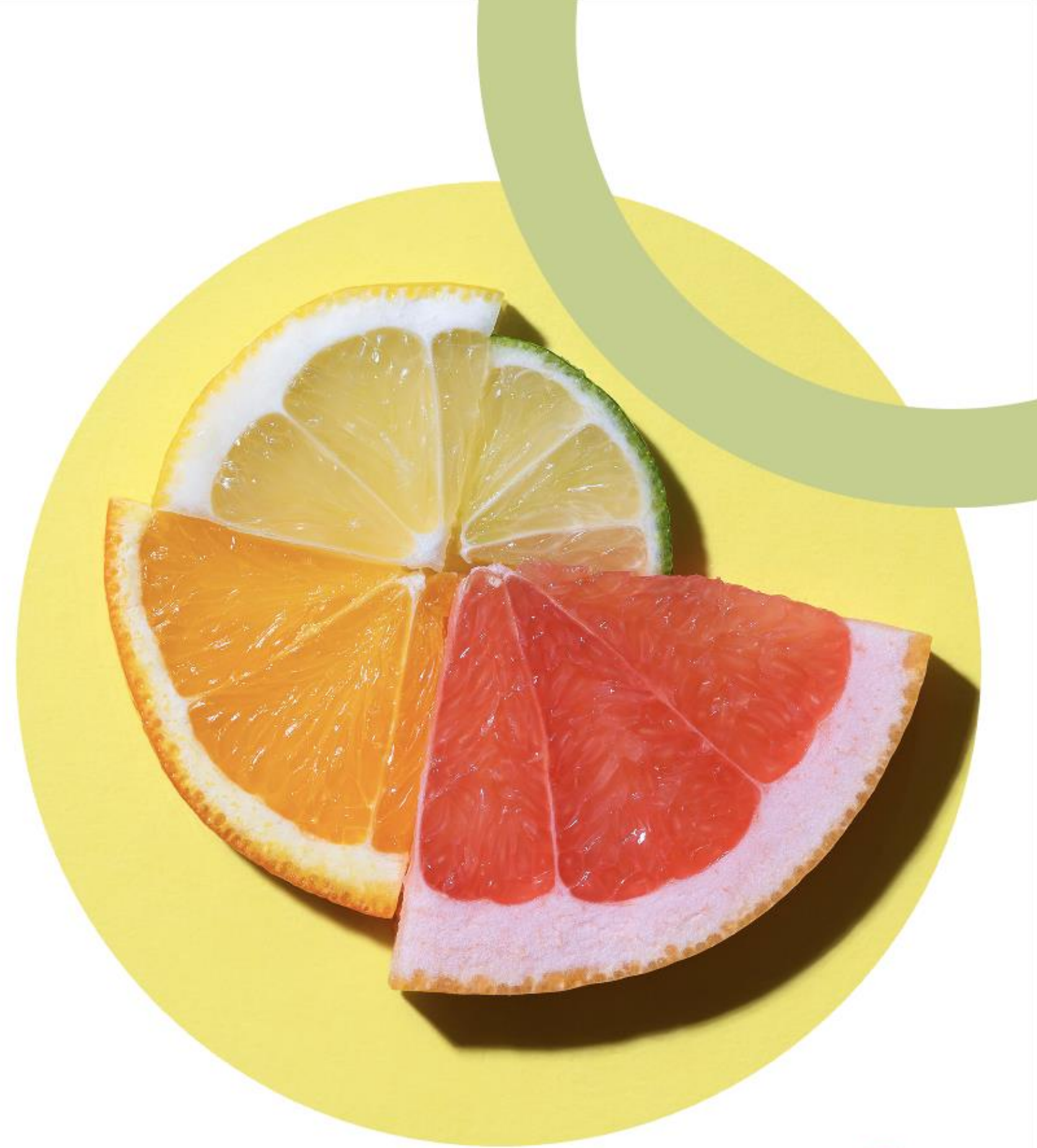
More than vit C – a complex & functional superfood



Reconnect & challenge biases



Up-to-date information & placed in context



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