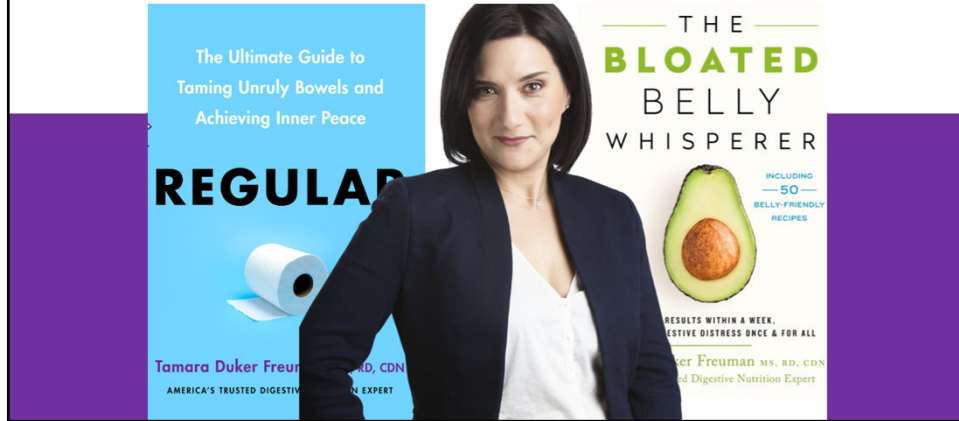


# What is an Anti-inflammatory diet?

July 2023

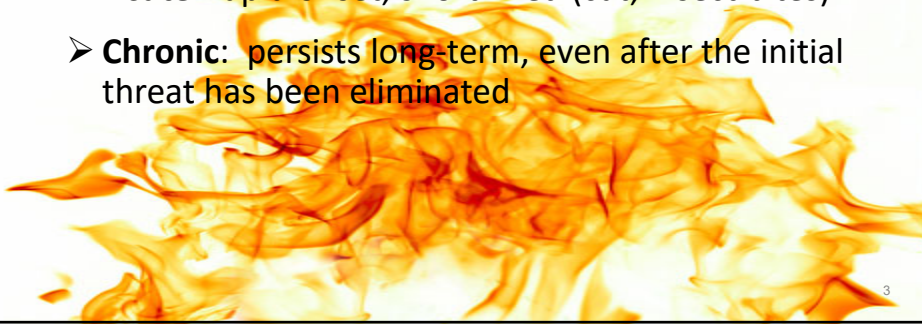
Tamara Duker Freuman, MS, RD, CDN



## What is inflammation?

A complex biological response to pathogens, damaged cells/injury or irritants aimed at removing the pathogenic substance, promoting healing, and restoring normal structure and function.

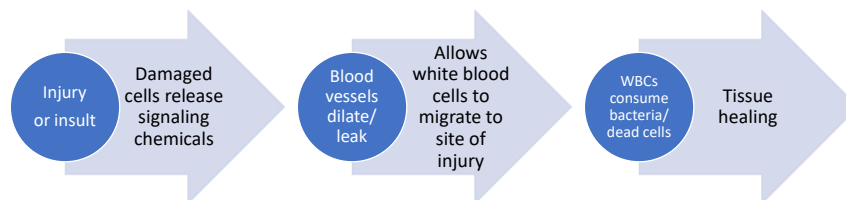
- **Acute:** rapid onset, short-lived (cut, insect bites)
- **Chronic:** persists long-term, even after the initial threat has been eliminated



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## Acute inflammation

May occur in response to cuts/injuries, insect bites, burns, allergic reactions, infections



Signs of acute inflammation: pain, swelling, heat and redness

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## Chronic inflammation

Ongoing immune system activation maintains a prolonged, low-grade inflammatory response

- “Smoldering disease”: Cellular and tissue damage occurs in the body for years, at levels below the threshold of clinical diagnosis
- Chronic, low-grade inflammation damages tissues/cells

Inflammation → oxidative stress → damages cell membranes and leads to DNA damage/mutations

- Chronic inflammation a known predisposing factor to cancer development
  - gastritis → stomach cancer;
  - esophagitis → esophageal cancer;
  - colitis → colon cancer
- Other diseases associated with chronic inflammation: obesity, type 2 diabetes, arthritis, fatty liver disease, cardiovascular disease, neurological diseases...



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## How is inflammation measured?

Certain biomarkers in the blood, stool and/or on tissue samples can indicate an elevated degree of inflammation

**High blood levels of proteins made by the liver for defense against foreign bodies, e.g.,**

- C-Reactive Protein (CRP)
- Complement C3
- Complement C4
- Fibrinogen
- Ferritin
- Ceruloplasmin

**Elevated blood levels of signaling molecules related to the inflammatory process, e.g.,**

- Interleukin-6 (IL-6) and other interleukins
- TNF-alpha
- Cyclooxygenase (COX)-2
- 5-lipoxygenase (5-LOX)

**In the GI tract: Elevated levels of white blood cells or proteins associated with them, e.g.,**

- Eosinophils
- Lymphocytes
- Calprotectin (stool test)

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HABITUAL  
dietary  
PATTERNS  
can contribute to a  
PRO- or ANTI- inflammatory  
environment in the body\*

\* *Other contributors to chronic inflammation:*

- *poor dental health/periodontal disease*
- *high amounts of body fat*
- *chronic exposure to chemical irritants or infectious agents (e.g., mold, silica dust)*

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### Meet the Dietary Inflammatory Index (DII)

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Evidence-based, validated tool developed by researchers who reviewed over **1,900** studies to determine the relationship between certain food parameters and 6 inflammatory biomarkers in the body

Each food parameter was given a weighted score based on quantity AND quality of studies (scale: -1 to +1)

- ▶ + if pro-inflammatory
- ▶ 0 if neutral
- ▶ - if anti-inflammatory

Based on frequency and amount of intake of various foods, entire diets can then be scored on a scale from -9 (maximally anti-inflammatory) to +8 (maximally pro-inflammatory)

*Shivappa et al 2019*








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**Table 2**

Food parameters included in the dietary inflammatory index, inflammatory effect scores, and intake values from the global composite data set; Dietary Inflammatory Index Development Study, Columbia, SC, USA, 2011–2012

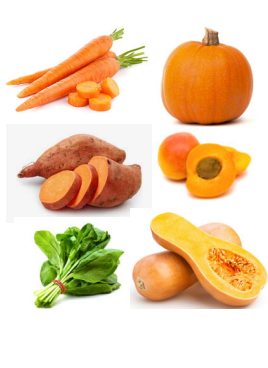


Food parameter	Weighted number of articles	Raw inflammatory effect score	Overall inflammatory effect score	Global daily mean intake (units/d)	SD
Alcohol (g)	417	-0.278	-0.278	13.98	3.72
Vitamin B <sub>12</sub> (µg)	122	0.205	0.106	5.15	2.70
Vitamin B <sub>6</sub> (mg)	227	-0.379	-0.365	1.47	0.74
β-Carotene (µg)	401	-0.584	-0.584	3718	1720
Caffeine (g)	209	-0.124	-0.110	8.05	6.67
Carbohydrate (g)	211	0.109	0.097	272.2	40.0
Cholesterol (mg)	75	0.347	0.110	279.4	51.2
Energy (kcal)	245	0.180	0.180	2056	338
Eugenol (mg)	38	-0.868	-0.140	0.01	0.08
Total fat (g)	443	0.298	0.298	71.4	19.4
Fibre (g)	261	-0.663	-0.663	18.8	4.9
Folic acid (µg)	217	-0.207	-0.190	273.0	70.7
Garlic (g)	277	-0.412	-0.412	4.35	2.90
Ginger (g)	182	-0.588	-0.453	59.0	63.2
Fe (mg)	619	0.032	0.032	13.35	3.71
Mg (mg)	351	-0.484	-0.484	310.1	139.4
MUFA (g)	106	-0.019	-0.009	27.0	6.1
Niacin (mg)	58	-1.000	-0.246	25.90	11.77
<i>n</i> -3 Fatty acids (g)	2588	-0.436	-0.436	1.06	1.06
<i>n</i> -6 Fatty acids (g)	924	-0.159	-0.159	10.80	7.50

## Flavonoids: Phytonutrients with antioxidant properties

Flavones (-0.616)	Isoflavones (-0.593)	Flavonols (-0.467)	Flavanols (-0.415)
  	 	 <p>Quercetin</p>	 <p>Tea (catechins) Cocoa (cocoa flavanols) Grapes/Red wine (resveratrol)</p>

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### Other antioxidant vitamins

Beta carotene (-0.584)	Vitamin E (-0.419)	Vitamin C (-0.424)
		




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### Omega 3 fatty acids (-0.436)







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## Anti-inflammatory compounds in herbs & spices

Eugenol (-0.140)	Turmeric (-0.785)	Ginger (-0.453)
 <p data-bbox="418 730 673 808">Found in: clove, cinnamon, nutmeg, basil bay leaf</p>		

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## Fiber (-0.663): Squelching inflammation by nourishing the gut microbiome

Fruits & Vegetables	Whole Grains	Legumes	Nuts & Seeds
<p data-bbox="345 1396 553 1564">All parts of the plant contain fiber: from fruits and flowers to stalks, roots, leaves and seeds</p> 	<p data-bbox="586 1396 800 1507">Fiber derives from the exterior coating of a grain (the bran)</p> 	<p data-bbox="821 1396 1036 1564">The skins and interiors of beans, chickpeas and lentils contain distinct types of fiber</p> 	<p data-bbox="1060 1396 1268 1535">Whole or ground nuts and seeds contain fiber, but the oils derived from them do not</p> 

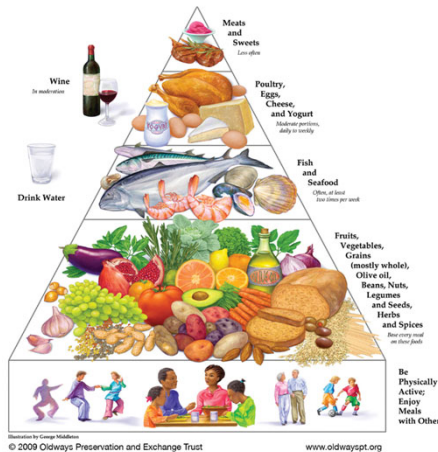
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## Dietary factors associated with a pro-inflammatory effect

Saturated fat (+0.373)	Trans Fats (+0.229)	Cholesterol (+0.110)

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## When it comes to inflammation, focus on dietary patterns, not individual foods, e.g.,



Oldways Mediterranean Diet Pyramid



Dr. Andrew Weil's Anti Inflammatory Diet Pyramid

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### Anti-inflammatory dietary patterns (according to the DII®)

Dietary patterns that score well based on the DII® will be primarily composed of individual foods/nutrients with NEGATIVE scores and low in foods/nutrients with more positive scores, e.g.,:

- Mediterranean diet
- DASH diet
- Dr. Weil's Anti-inflammatory Diet
- Other well-planned, plant-based diets low in saturated fat (Pescatarian, Flexitarian, Vegetarian, Vegan)

Anti inflammatory diet patterns have several common features:

- They are high in fiber
- They are especially rich in beans/legumes, vegetables and fruits
- They are low in ultra-processed foods
- None of them are gluten-free or grain free; some contain dairy, others do not
- They are low in saturated fat from meat/animal sources

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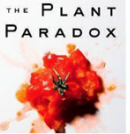
### Many popular diets *claim* anti-inflammatory benefits, but are at odds with the science



Restricts these anti-inflammatory foods	Emphasizes high intake of these pro-inflammatory foods
<ul style="list-style-type: none"> <li>• (High fiber) grains</li> <li>• Beans &amp; Legumes (including soy)</li> <li>• Peanuts</li> <li>• Red wine (all alcohol)</li> </ul>	<p>None, per se... but intake of higher cholesterol/saturated fat animal protein typically increases when grains, legumes, soy are eliminated</p>
<ul style="list-style-type: none"> <li>• (High fiber) grains</li> <li>• Beans &amp; Legumes (including soy)</li> <li>• Veggies in the nightshade family</li> <li>• ALL nuts</li> <li>• ALL seeds</li> <li>• Nutmeg/other antioxidant rich spices</li> <li>• Cocoa</li> <li>• Coffee</li> <li>• Red wine (all alcohol)</li> </ul>	<ul style="list-style-type: none"> <li>• Red meat</li> <li>• Organ meat ("aim for 5x/week, the more, the better")</li> <li>• Coconut/coconut oil</li> </ul>

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## Many popular diets *claim* anti-inflammatory benefits, but are at odds with the science

	Restricts these anti-inflammatory foods	Emphasizes high intake of these pro-inflammatory foods
	<ul style="list-style-type: none"> <li>• (High fiber) grains</li> <li>• Beans &amp; Legumes (including soy)</li> <li>• Most fruit (except small amounts of berries)</li> <li>• Root vegetables</li> <li>• Certain (orange) squashes</li> </ul>	<ul style="list-style-type: none"> <li>• Red meat</li> <li>• Full-fat dairy products (saturated)</li> <li>• Egg yolks/mayonnaise</li> <li>• Coconut/coconut oil</li> </ul>
	<ul style="list-style-type: none"> <li>• (High fiber) whole grains</li> <li>• Beans &amp; Legumes (including soy)</li> <li>• All fruits except berries <u>in season</u></li> <li>• Nuts: peanuts, cashews</li> <li>• Seeds: pumpkin, chia, sunflower</li> <li>• Veggies in the nightshade family</li> <li>• Squashes</li> </ul>	<ul style="list-style-type: none"> <li>• Red meat (4oz/day)</li> <li>• Egg yolks (4 yolks/day)</li> <li>• Butter/ghee</li> <li>• Heavy cream/cream cheese</li> <li>• Cheese (from buffalo, goat, sheep)</li> <li>• Coconut/coconut oil</li> </ul>

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## Are certain food additives pro-inflammatory?

The DII does not score food additives specifically

Higher intake of “ultraprocessed foods” is increasingly linked to risk of developing Inflammatory Bowel Disease (IBD) in a “dose dependent manner”

- Ultraprocessed foods include: soft drinks; salty snacks like chips; sweet treats like packaged cookies, cakes and bars; and processed meats

Based on available research, the International Organization for the Study of Inflammatory Bowel Disease (IOIBD) recommends limiting intake of ultra-processed foods, especially with these ingredients:

- Carrageenan
- Maltodextrin
- Titanium dioxide
- Artificial sweeteners
- Certain emulsifiers, such as mono and di-glycerides, polysorbates, carboxymethylcellulose (cellulose gum)



WATER, PALM OIL, MALTODEXTRIN, CONTAINS 2% OR LESS OF: SODIUM CASEINATE\* (A MILK DERIVATIVE), DIPOTASSIUM PHOSPHATE, SODIUM STEAROYL LACTYLATE, MONO AND DIGLYCERIDES, CARRAGEENAN, POLYSORBATE 60, SUCRALOSE, GELLAN GUM, ACESULFAME POTASSIUM, NATURAL AND ARTIFICIAL FLAVORS.

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## Key takeaways

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**Individual foods do not cause acute inflammation (unless you have an actual allergy to them), but overall dietary patterns *can* contribute to chronic inflammation**

- Most “dietary demons” singled out by fad diets as inflammatory are actually not: gluten/whole grains, all dairy/casein, legumes, “nightshade vegetables,” soy...

**Many purportedly ‘anti-inflammatory’ diets restrict some of the most anti-inflammatory foods, and many even encourage higher intake of pro-inflammatory ones**

**More diverse, plant based diets tend to be more anti-inflammatory**

- Strict elimination diets that cut out entire categories of plant-based foods may do more harm than good by:
  - Starving the gut microbiome → degrading the mucosal gut barrier & reducing production of anti-inflammatory microbial metabolites (short chain fatty acids)
  - Limiting access to variety of anti-inflammatory/anti-oxidant food compounds

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Questions?

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