Diet and Chronic Inflammation[1]

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Inflammation is your body's response to injury and infection—it's how your immune system helps to protect you from harm. In contrast, chronic inflammation contributes to many diseases, including heart disease, diabetes, and kidney and liver disease. This publication discusses inflammation and the dietary choices that may help to reduce chronic inflammation.

Inflammation

Inflammation is part of the complex response of our body to harmful stimuli, such as bacteria, viruses, toxins, or even our own damaged cells. Through inflammation, the immune system can help eliminate disease-causing organisms and substances and promote tissue repair and recovery after an injury. Acute inflammation occurs when your body detects a harmful stimulus or damaged body tissue and reacts by sending out immune cells and substances around the affected area to help you heal. The site of inflammation, such as a cut or burn, becomes red, swollen, and warm—signs of inflammation that disappear with healing. In contrast, chronic inflammation occurs when the immune system continues to be activated, fighting too much and for too long. Chronic inflammation contributes to heart disease, diabetes, chronic kidney disease, non-alcoholic fatty liver disease, dementia, and autoimmune and movement disorders, among others (Furman et al. 2019).

How to Measure Inflammation

Your healthcare provider may test your blood for markers of inflammation; a common test is C-reactive protein (CRP). CRP is used to assess the severity of inflammation during illness or chronic disease. High-sensitivity C-reactive protein (hs-CRP) is used to test for risk of cardiovascular disease (Li et al. 2017). Other common markers of inflammation include the interleukin (IL) family (e.g., IL-6) and tumor necrosis factor alpha (TNF-α). Although CRP is commonly used by physicians to determine severity of disease, other inflammatory markers are more often measured in scientific studies.

The American Diet and Chronic Inflammation

The typical American diet is characterized by a low intake of fruits, vegetables, and fiber, and a high intake of refined grains and processed meats (USDHHS and USDA 2015). This diet is particularly high in ultraprocessed foods—foods that are highly processed with additives (Martínez Steele et al. 2016). This dietary pattern is thought to alter the gut microbiota composition, intestinal environment, and immune system, which ultimately leads to chronic inflammation (Furman et al. 2019). Overconsumption of ultraprocessed foods in particular may also promote obesity, which further provokes chronic inflammation (Spyridaki, Avgoustinaki, and Margioris 2016). By improving diet quality and maintaining a healthy weight, risk of chronic inflammation may be decreased.

While a low-quality diet promotes chronic inflammation, some dietary patterns and foods may help with prevention of diseases related to chronic inflammation.

Diet and Chronic Inflammation

Fruits and vegetables contain vitamins, minerals, fiber, and phytonutrients (beneficial substances in plants) that promote health and may help to prevent chronic inflammation. A higher intake of fruits and vegetables leads to a decrease in inflammatory markers, specifically CRP and TNF-α (Hosseini et al. 2018). The Dietary Guidelines for Americans provides guidance on the types and amounts of fruits and vegetables for good health (USDHHS and USDA 2015). Choosing more fruits and vegetables may help to avoid undesired chronic inflammation.

Whole grains contain fiber, vitamins, minerals, and phytonutrients that promote health. Although some studies show that higher intakes of whole grains are associated with decreased inflammation, other studies do not confirm this relationship. However, in unhealthy individuals, markers of inflammation improve with higher intakes of whole grains (Rahmani et al. 2020). The Dietary Guidelines for Americans recommends choosing whole grains to promote health (USDHHS and USDA 2015).

Dairy foods provide an important source of protein, calcium, and other nutrients, and may help to decrease chronic inflammation. Research supports that higher consumption of dairy foods compared with low or no intake, led to reduced inflammatory markers including CRP, TNF-α, and IL-6 (Moosavian et al. 2020).

Replacing solid fats with healthy oils is recommended in the Dietary Guidelines for Americans (USDHHS and USDA 2015). **Olive oil** intake has been shown to decrease inflammatory markers, specifically CRP and IL-6 (Schwingshackl, Christoph, and Hoffmann 2015). However, the evidence for **omega-3 fats**, found in fish and flaxseed, for improving inflammation is less certain. In a review of studies that tested the effects of omega-3 intake on inflammatory markers, no clear benefits of omega-3 were identified (Natto et al. 2019).

Dietary Patterns and Chronic Inflammation

Food synergy is the idea that more benefit can be obtained by healthful dietary patterns, rather than from single foods or nutrients (Jacobs, Gross, and Tapsell 2009). Some plant-based diets, given their combination of healthful foods, seem to be promising for decreasing inflammation.

A **plant-based** dietary pattern emphasizes whole grains, fruits, vegetables, legumes, nuts, and plant-sourced oils, and may or may not include animal products. Plant-based dietary patterns include the Mediterranean diets, Dietary Approaches to Stop Hypertension (DASH), and various forms of a vegetarian diet, among others. As a whole, plant-based foods have been shown to be associated with overall improvement in inflammatory profiles when compared with other dietary patterns (Eichelmann et al. 2016).

A **vegetarian** dietary pattern excludes meat, poultry, and seafood, and may or may not include products derived from animals such as dairy and eggs. Healthful vegetarian diets were associated with decreased inflammatory markers when compared to a well-balanced mixed diet, a diet for type 2 diabetes, various habitual mixed diets, and a diet based on the American Heart Association guidelines (Craddock et al. 2019). However, more studies are needed to confirm whether vegetarian diets are protective against chronic inflammation. If you are a vegetarian, or you are planning to become one, talk to a registered dietitian or other health care provider to make sure your diet choices meet your nutrient needs. A healthful vegetarian dietary pattern may help to reduce inflammation.

The **DASH** diet was designed to improve blood pressure and has also been shown to help prevent cardiovascular disease (Siervo et al. 2015). The diet promotes fruits, vegetables, and low-fat and fat-free dairy products, as well as whole grains, poultry, fish, nuts, seeds, and legumes, while restricting refined grains, sugary beverages, saturated fats, and red meats. The DASH diet is low in saturated fat and sodium and promotes foods higher in potassium, calcium, magnesium, and fiber. The DASH diet decreases the inflammatory marker hs-CRP, compared to usual diets, but was no better than other healthy dietary patterns (Soltani, Chitsazi, and Salehi-Abargouei 2018). Consuming a healthy diet, such as the DASH diet, may help to decrease inflammatory markers.

The **Mediterranean** dietary pattern promotes virgin olive oil, vegetables, fruits, whole grains, fish, a moderate intake of poultry, eggs, dairy and alcohol, and low red meat, sweets, and pastry consumption. Several studies have studied the effects of a Mediterranean dietary pattern on inflammatory markers. A review of these studies found that the Mediterranean dietary pattern improved several markers of inflammation (e.g. hs-CRP, IL-6) (Schwingshackl and Hoffmann 2014). Overall, the Mediterranean

dietary pattern is a good option to promote health and may decrease chronic inflammation.

A **low glycemic** diet is a dietary pattern that focuses on choosing low glycemic index (GI) foods and foods with a lower glycemic load (GL). Glycemic index is not only important for the control of blood glucose for those living with diabetes but may also play a role in decreasing inflammation (Schwingshackl and Hoffmann 2013). A review of studies has shown that decreases in the inflammatory marker CRP were more pronounced in adults who consumed lower GI/GL, compared to those who consumed higher GI/GL foods, even when studies including adults with type 2 diabetes were excluded (Schwingshackl and Hoffmann 2013). Adopting long-term, low glycemic diets may help to decrease inflammation.

> **Glycemic Index (GI)** is a way of ranking foods based on their effects on blood glucose in relation to a reference food.
> **Glycemic load (GL)** takes into account the amount of available carbohydrate in a serving of food. GL is calculated by multiplying the GI of a particular food by the amount of "available" carbohydrate in a serving of the food and dividing this factor by 100. "Available" carbohydrate is that which is digested and absorbed as sugar (e.g., total carbohydrate in the food minus the fiber). Foods with lower GI, such as legumes, slowly release glucose into the bloodstream, whereas foods with higher GI, such as bread and most breakfast cereals, release glucose rapidly. The GI of carrots is high, but when considering the low carbohydrate content of carrots, they have a low GL. Considering both the GI and GL is important when choosing a low glycemic diet.

Conclusion

Inflammation helps you heal, whereas chronic inflammation contributes to chronic disease. Healthful dietary patterns and food choice may help to reduce chronic inflammation, whereas the typical American diet and obesity promote inflammation. Healthful plant-based dietary patterns, with an emphasis on fruits, vegetables, whole grains, legumes, nuts, and seeds may help to reduce chronic inflammation.

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