



## Biochemistry and Nutritional Health Benefits of Avocado (*Persea americana*): an overview

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### Abstract:

The avocado (*Persea americana*), is well known for its distinct biochemical makeup and wide range of health advantages. With an emphasis on the avocado's lipid profile, carbohydrate content, protein composition, vitamin and mineral richness, and presence of bioactive phytochemicals, this article attempts to give a thorough summary of the avocado's biochemistry. Additionally, it looks at how eating avocados can improve nutritional status in terms of weight management, anti-inflammatory effects, digestive health, eye health, skin and hair health, and cardiovascular health.

### 1. Introduction:

Avocados are nutrient-dense fruits that have become very popular recently because of their many culinary applications and health advantages (Comerford et al., 2016). Originating in Central and South America, it has been farmed for millennia and is currently found in many parts of the world (Iriarte et al., 2020). This review delves deeply into the molecular composition of avocados and how they affect human health, offering a comprehensive explanation of why these fruits are frequently referred to as superfoods.

#### 1.1 Biochemistry of Avocado

##### *Lipid Composition*

Avocados contain a lot of fat, mostly in the form of monounsaturated fatty acids (MUFA), which make up around 70% of their total fat content (Flores et al., 2019). Oleic acid, the main

monounsaturated fatty acid, is well-known for its positive benefits on cardiovascular health (López-Miranda et al., 2006). Avocados also contain trace levels of saturated and polyunsaturated fats (Wang et al., 2015). Avocados' distinct lipid profile adds to their creamy texture and range of health advantages.

### ***Carbohydrates and Fibre***

Avocados are mostly composed of dietary fibre and contain very little carbohydrates (Dreher and Davenport, 2013). The majority of the fibre in avocados is insoluble, which helps to maintain regular bowel motions and stave against constipation (Hill, 2015). Avocados have a low glycemic index, which makes them a good choice for people who are controlling their blood sugar (Pathiwada, 2023).

### ***Protein Composition***

Avocados are a great source of supplemental protein since they contain all essential amino acids, while not being a substantial supply of protein (Comerford et al., 2016). These amino acids are necessary for many biological processes, such as tissue healing and enzyme synthesis (Albaugh et al., 2017).

### ***Vitamins***

Avocados are rich in several essential vitamins (Dreher et al., 2013):

- **Vitamin K:** Important for blood clotting and bone health.
- **Vitamin E:** An antioxidant that protects cells from oxidative damage.
- **Vitamin C:** Crucial for immune function and skin health.
- **B Vitamins:** Including B5 (pantothenic acid), B6 (pyridoxine), and folate, which are vital for energy metabolism and neurological function.

### ***Minerals***

Avocados include magnesium, which is involved in over 300 metabolic events in the body, including muscle and nerve function, and potassium, which helps regulate blood pressure and supports cardiovascular health (Zuraini et al., 2021).

### ***Phytochemicals***

Avocados contain various bioactive compounds, such as (Salazar-López et al., 2020):

- **Carotenoids:** Including lutein and zeaxanthin, which are beneficial for eye health.
- **Polyphenols:** These have antioxidant properties that help reduce oxidative stress and inflammation.

**Table: 1** Nutritional value of Avocado per 100 g

Item	Avocado, raw (edible parts) Nutritional value per 100 g (3.5 oz)
Energy	670 kJ (160 kcal)
Carbohydrates	8.53 g
Sugars	0.66 g
Dietary fiber	6.7 g
Fat	14.66 g
Protein	2 g
Thiamine (Vit. B <sub>1</sub> )	0.067 mg (5%)
Riboflavin (Vit. B <sub>2</sub> )	0.130 mg (9%)
Niacin (Vit. B <sub>3</sub> )	1.738 mg (12%)
Pantothenic acid (B <sub>5</sub> )	1.389 mg (28%)
Folate (Vit. B <sub>9</sub> )	81 µg (20%)
Vitamin C	10 mg (17%)
Magnesium	29 mg (8%)
Phosphorus	52 mg (7%)
Potassium	485 mg (10%)
Zinc	0.64 mg (6%)

Table: 2 Total phenol, total flavonoid, total tannin, saponin level, total alkaloids of methanolic extract of avocado peels (Rahman et al., 2022)

Parameter	Measurement result		
	a	b	Mean±SD
Total phenol (mg/100 g extract)	21.750	21.917	21.833±0.118
Total flavonoids (mg/100 g extract)	2.529	2.686	2.607±0.111
Total tannins (mg/100 g extract)	38.214	38.500	38.357±0.202
Saponin content (%)	0.852	0.896	8.874±0.031
Total alkaloids (mg CE/g extract)	9.975	9.925	9.95 ± 0.035

## 1.2 Nutritional Health Benefits

### 1.2.1 Cardiovascular Health

Avocados' high MUFA content—especially oleic acid—helps raise levels of good HDL cholesterol and lower levels of bad LDL cholesterol (James et al., 2022). This fruit's potassium level and lipid profile work together to control blood pressure, lower the risk of hypertension, and prevent cardiovascular illnesses, all of which improve heart health (Reddy and Katan, 2004).

### Biochemical Composition of Avocado Relevant to Cardiovascular Health

#### Lipid Profile

Avocados are rich in fats, predominantly monounsaturated fats (about 70% of their total fat content), primarily oleic acid. MUFAs are known to:

- **Reduce LDL Cholesterol:** Elevated LDL cholesterol is a significant risk factor for CVD. MUFAs help lower LDL cholesterol levels, which can reduce plaque buildup in arteries.
- **Increase HDL Cholesterol:** HDL cholesterol helps remove LDL cholesterol from the bloodstream, further reducing CVD risk (Dreher and Davenport, 2013).

#### Fibre

A medium avocado contains about 10 grams of dietary fibre. Fibre is known to:

- **Lower Cholesterol Levels:** Soluble fibre binds to cholesterol in the digestive system, reducing its absorption into the bloodstream.
- **Promote Satiety:** This can help with weight management, which is crucial for preventing and managing CVD (Igel et al., 2018).

#### Vitamins and Minerals

- **Potassium:** Avocados are high in potassium, which helps regulate blood pressure by balancing sodium levels and reducing tension in blood vessel walls. High potassium intake is associated with a lower risk of stroke (Campbell-McBride, 2018).
- **Magnesium:** Essential for heart health, magnesium helps maintain normal heart rhythm and function (Gröber et al., 2015).
- **Vitamin E:** An antioxidant that helps prevent oxidative damage to cholesterol, reducing the risk of atherosclerosis (Zhang et al., 2014).
- **Folate:** Involved in homocysteine metabolism; high homocysteine levels are a risk factor for CVD (Andreotti et al., 2000).

**Bioactive Compounds**

- **Phytosterols:** Compounds like beta-sitosterol in avocados can reduce cholesterol absorption in the intestine (Ramos-Aguilar et al., 2019).
- **Polyphenols and Carotenoids:** These antioxidants reduce oxidative stress and inflammation, both of which are linked to CVD (Siti et al., 2015).

**Mechanisms of Action****Cholesterol Management**

Consuming avocados on a regular basis has been demonstrated in several studies to enhance lipid profiles. The high MUFA content—especially oleic acid—helps improve the lipid profile by lowering LDL cholesterol and raising HDL cholesterol (Pieterse et al., 2003).

**Blood Pressure Regulation**

Avocados' high potassium content is essential for controlling blood pressure. Potassium helps reduce blood pressure and lowers the risk of hypertension and stroke by counteracting the effects of sodium (Sutiningsih et al., 2023).

**Anti-inflammatory Effects**

One of the main causes of atherosclerosis and other cardiovascular diseases is chronic inflammation. Avocados include bioactive substances called carotenoids and polyphenols that have anti-inflammatory qualities that can help lessen inflammation in the cardiovascular system (Jimenez et al., 2021).

**Antioxidant Protection**

Atherosclerosis develops as a result of oxidative stress. Avocados are rich in antioxidants, including vitamin E, polyphenols, and carotenoids, which shield LDL cholesterol from oxidative damage and stop plaque from building up in arteries (Ferreira et al., 2013).

**Weight Management**

One of the main risk factors for CVD is obesity. Avocados' fibre and good fats help control hunger and increase satiety, which can help with weight management and lower the risk of cardiovascular problems linked to obesity (Zhu et al., 2019).

**1.2.2 Anti-inflammatory Effects**

Avocados' MUFAs and antioxidants have anti-inflammatory qualities. Frequent avocado eating can help lower inflammation, which is advantageous for inflammatory diseases and conditions including arthritis (DiNubile, 2010).

**1.2.3 Digestive Health**

Avocados' high dietary fibre content encourages regular bowel motions and a healthy digestive system. In addition, fibre promotes a healthy gut flora, which is essential for maintaining digestive health in general and preventing gastrointestinal illnesses (Gill et al., 2021).

**Biochemical Composition of Avocado Relevant to Digestive Health****Fibre**

Avocados are an excellent source of dietary fibre, providing about 10 grams per medium fruit. Dietary fibre is classified into two types:

- **Soluble Fibre:** This type dissolves in water to form a gel-like substance, which can help regulate blood sugar levels and lower cholesterol (Mudgil and Barak, 2013).

- **Insoluble Fibre:** This type adds bulk to the stool and helps food pass more quickly through the stomach and intestines, aiding in regular bowel movements and preventing constipation (Djuraeva et al., 2023).

### ***Healthy Fats***

The monounsaturated fats (MUFAs) in avocados, primarily oleic acid, play a role in maintaining a healthy digestive system by:

- **Supporting Absorption of Fat-Soluble Nutrients:** These fats aid in the absorption of vitamins A, D, E, and K, which are crucial for various bodily functions, including digestive health (Mariamenatu and Abdu, 2021).

### ***Vitamins and Minerals***

- **Vitamin E:** This antioxidant protects the mucosal lining of the digestive tract from oxidative damage.
- **Folate:** Important for DNA synthesis and repair, folate supports the health of the gut lining.
- **Potassium:** Helps maintain electrolyte balance and proper muscle function, which is essential for digestive motility (Zhao et al., 2021).

### ***Bioactive Compounds***

- **Phytosterols:** Compounds that can improve gut health by enhancing the integrity of the intestinal barrier and modulating gut microbiota (Hiippala et al., 2018).
- **Polyphenols:** These antioxidants have anti-inflammatory properties that can protect the digestive tract from inflammation and oxidative stress (Kim et al., 2012).

### **Mechanisms of Action**

#### ***Regulation of Bowel Movements***

The high fibre content in avocados, particularly insoluble fibre, adds bulk to the stool and promotes regular bowel movements. This helps prevent constipation and supports a healthy digestive transit time. Soluble fibre, on the other hand, helps maintain stool consistency, preventing both constipation and diarrhea (Bosaeus, 2004).

#### ***Gut Microbiota Support***

Dietary fibre in avocados acts as a prebiotic, providing nourishment for beneficial gut bacteria. A healthy gut microbiota is essential for efficient digestion, immune function, and the prevention of gastrointestinal disorders such as irritable bowel syndrome (IBS) and inflammatory bowel disease (IBD).

#### ***Anti-inflammatory and Antioxidant Effects***

The antioxidants and anti-inflammatory compounds in avocados, such as polyphenols and vitamin E, protect the digestive tract from inflammation and oxidative stress. This protection helps maintain the integrity of the gut lining and prevent conditions like gastritis and colitis (Bhattacharyya et al., 2014).

#### ***Enhanced Nutrient Absorption***

The monounsaturated fats in avocados enhance the absorption of fat-soluble vitamins and other nutrients. Improved nutrient absorption ensures that the body gets adequate vitamins and minerals essential for digestive health and overall well-being (Godswill et al., 2020).

#### ***Prevention of Digestive Disorders***

Regular consumption of avocados can help prevent various digestive disorders. The fibre and healthy fats promote a healthy gut environment, reducing the risk of conditions like diverticulitis, IBS, and colorectal cancer (Cabré, 2011).

#### **1.2.4 Eye Health**

Carotenoids such as lutein and zeaxanthin in avocados are associated with a lower risk of age-related macular degeneration and cataracts. These compounds help protect the eyes from oxidative stress and damage caused by ultraviolet light (Ivanov et al., 2018).

#### **1.2.5 Weight Management**

Despite being high in fats, avocados can aid in weight management due to their high fibre and healthy fat content. These nutrients promote satiety, helping to control appetite and reduce overall calorie intake. Additionally, the low carbohydrate content makes avocados suitable for low-carb and ketogenic diets (Kopec et al., 2014).

#### **1.2.6 Nutrient Absorption**

Avocados enhance the absorption of fat-soluble vitamins (A, D, E, K) and antioxidants from other foods. Including avocados in meals can improve the bioavailability of these nutrients, maximizing their health benefits (Kopec et al., 2014).

#### **1.2.7 Skin and Hair Health**

The vitamins, minerals, and healthy fats in avocados contribute to skin and hair health. Vitamin E and C, along with biotin, support skin elasticity, hydration, and collagen production, while the healthy fats nourish the scalp and hair (Trüeb and Trüeb, 2020).

## **2. Conclusion**

Avocados are a fruit that is high in nutrients and has a special biochemical makeup. They are also very beneficial to human health. They are a great complement to a balanced diet because of their lipid profile, fibre content, vital vitamins and minerals, and bioactive phytochemicals. Frequent avocado eating can improve the health of skin and hair, lower inflammation, boost digestive system function, improve nutrient absorption, and support cardiovascular health. Avocados are rightfully regarded as a superfood with enormous potential to enhance general health and well-being in light of these advantages.

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