

# Pharmacological, Nutritional, Medicinal and Industrial uses of Coffee: Benefits and Health Risks

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## Abstract

Coffee is one of the most widely consumed beverages worldwide, valued not only for its stimulating effects but also for its pharmacological, nutritional, medicinal, and industrial applications. This review explores the chemical composition of coffee, its health benefits, industrial uses, and potential risks associated with excessive consumption. Coffee contains bioactive compounds such as caffeine, polyphenols, chlorogenic acids, and diterpenes, which contribute to its antioxidant, anti-inflammatory, neuroprotective, and metabolic effects. Epidemiological studies suggest that moderate coffee consumption is linked to a reduced risk of neurodegenerative diseases (Alzheimer's and Parkinson's), improved cardiovascular and metabolic health, and liver protection. Additionally, coffee has industrial applications in pharmaceuticals, cosmetics, and sustainable waste management, with spent coffee grounds being repurposed for biofuels and composting. Despite its numerous benefits, excessive coffee intake can lead to caffeine dependence, sleep disturbances, gastrointestinal issues, and increased cholesterol levels in certain individuals. Unfiltered coffee, in particular, contains diterpenes that may elevate low density lipoprotein (LDL) cholesterol, posing risks for cardiovascular health. Pregnant women and individuals with hypertension or acid reflux are advised to moderate their coffee intake. Future research should focus on personalized coffee consumption guidelines, further investigating long-term health impacts and optimizing the sustainability of coffee by-products. While coffee remains a functional beverage with significant health and industrial advantages, a balanced approach to consumption is necessary to maximize benefits while minimizing risks. This review underscores the importance of moderation, individual health considerations, and sustainable practices in the coffee industry.

**Keywords:** health risks; coffee; caffeine; neuroprotection; cardiovascular health

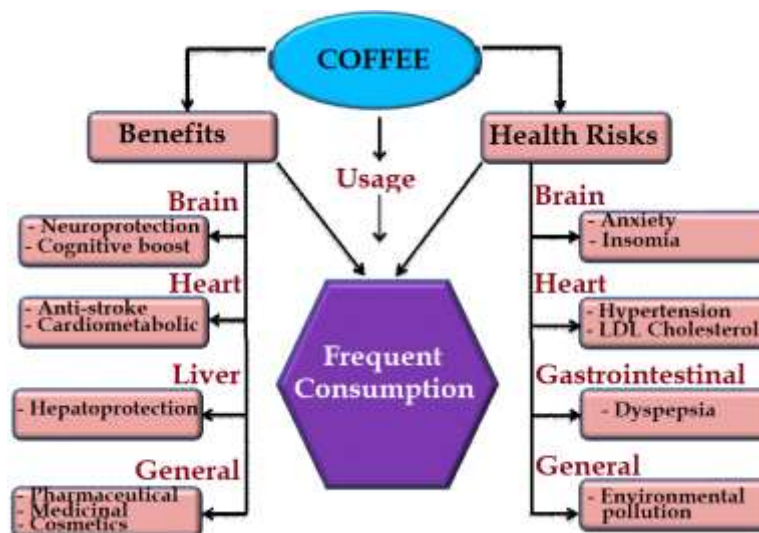
## 1.Introduction

Coffee is one of the most widely consumed beverages globally, with a rich cultural, economic, and medicinal significance. Originating from the coffee plant (*Coffea* spp.), particularly *Coffea arabica* and *Coffea canephora* (commonly known as Robusta), coffee has been cultivated and consumed for centuries. Its popularity is largely attributed to its stimulating effects, primarily due to caffeine, a natural psychoactive compound that enhances alertness and cognitive function (Pérez-Hernández *et al.*, 2022). Beyond its role as a daily stimulant, coffee contains a diverse range of bioactive compounds, including polyphenols, chlorogenic acids, and diterpenes, which contribute to its pharmacological and health-related properties (Poole *et al.*, 2017). The

increasing scientific interest in coffee extends beyond its stimulating effects to its potential health benefits and risks (Fig 1). Studies suggest that moderate coffee consumption is associated with various health benefits, including neuroprotection, reduced risk of cardiovascular diseases, and improved metabolic functions (Nieber, 2017). Additionally, coffee has been recognized for its anti-inflammatory and antioxidant properties, which may play a role in preventing chronic diseases such as diabetes, liver disorders, and certain cancers (Grosso *et al.*, 2017). Apart from its medicinal and nutritional value, coffee has significant industrial applications. The beverage industry has expanded coffee-based products, including instant coffee, functional beverages, and decaffeinated

varieties. Furthermore, coffee by-products, such as spent coffee grounds, are being explored for sustainable applications in biofuel production, cosmetics, and agriculture (Janissen and Huynh, 2018). Despite these benefits, excessive coffee consumption has been linked to certain health concerns, including caffeine-dependency, sleep disturbances, increased heart rate, and gastrointestinal discomfort (Cornelis, 2019a). Concerns have been raised regarding the potential adverse effects of coffee. Although, the bioactive compounds, such as polyphenols and chlorogenic acids, exhibit antioxidant and anti-inflammatory properties, their long-term effects and interactions with other dietary and lifestyle factors remain underexplored. Additionally, the utilization of coffee by-products in industrial applications, such as cosmetics, biofuels, and agriculture, presents an opportunity for sustainable resource management, yet research on optimizing these applications is still limited. Given these conflicting perspectives and knowledge gaps, there is a need for a comprehensive review that critically examines coffee's pharmacological, nutritional, medicinal, and industrial applications while addressing both its benefits and potential health risks. Understanding the effects of coffee consumption on human health is essential for both consumers and healthcare professionals. While numerous studies highlight coffee's

potential benefits, such as its antioxidant, anti-inflammatory, and neuroprotective properties, there is still considerable debate regarding its long-term impact, particularly in relation to cardiovascular health, sleep patterns, and metabolic disorders. Furthermore, the industrial application, including its use in pharmaceuticals, cosmetics, and sustainable waste management, underscore its economic and environmental importance. Exploring these applications can contribute to advancements in health science, biotechnology, and sustainable industry practices. By conducting a comprehensive review of coffee's diverse roles, this study will provide valuable insights into its health implications and industrial potential. This research will aid in guiding consumers, healthcare practitioners, policymakers, and industry stakeholders in making informed decisions regarding coffee consumption, regulation, and innovation. This review aims to provide a comprehensive analysis of coffee's pharmacological, nutritional, medicinal, and industrial applications while critically evaluating its benefits and potential health concerns. By examining current scientific literature, this review highlights coffee's diverse roles to provide a balanced perspective on coffee consumption and its implications for human health and industry as described in Figure 1 below.



**Figure 1:** The benefits and health risks associated with frequent coffee consumption

## 2.0 Review Framework

### 2.0.1 Review Focus

This study employed a qualitative research approach by conducting a systematic review of existing literature on the pharmacological, nutritional, medicinal, and industrial applications of coffee. The methodology consists of the following steps:

### 2.0.2 Study Design

A systematic literature review was used to gather, analyze, and synthesize published research findings related to coffee's benefits and health concerns. This method was chosen to provide a comprehensive and balanced perspective on the topic by integrating multiple sources of evidence.

### 2.1 Data Collection

#### 2.1.0 Selection of Data Sources

Relevant scientific studies, review articles, and meta-analyses were sourced from reputable databases, including:

- PubMed (Biomedical and health sciences literature)
- ScienceDirect (Pharmacological and industrial research)
- Google Scholar (General academic articles)
- Web of Science (Multidisciplinary peer-reviewed research)
- Scopus (Comprehensive database for scientific literature)

#### 2.1.2 Data Inclusion Criteria

The following criteria were used to select relevant literature:

- Timeframe: Articles published within the last 10 years (2014–2024) to ensure up-to-date research.
- Language: Only studies published in English were considered.

- Relevance: Studies focusing on coffee's bioactive compounds, pharmacological effects, health benefits, health risks, and industrial applications.
- Study Type: Meta-analyses, systematic reviews, randomized controlled trials (RCTs), observational studies, and experimental research.

### 2.1.3 Data Exclusion Criteria

The following studies were excluded:

- Non-peer-reviewed sources, opinion pieces, and editorial articles.
- Studies with limited scientific rigor or small sample sizes lacking statistical significance.
- Research focusing solely on coffee production and cultivation without discussing its health implications.

## 2.2 Data Analysis

### 2.2.1 Thematic Analysis

Collected data were analyzed using thematic analysis, which involved categorizing studies into the following key themes:

- Chemical composition of coffee (bioactive compounds such as caffeine, polyphenols, chlorogenic acids, diterpenes).
- Pharmacological effects (neurological, cardiovascular, metabolic, and anti-inflammatory properties).
- Nutritional aspects (micronutrient content, antioxidant properties).
- Medicinal applications (therapeutic benefits, disease prevention).
- Industrial uses (pharmaceuticals, cosmetics, biofuel, and sustainability applications).
- Health concerns and risks (caffeine dependence, cardiovascular risks, gastrointestinal effects).

### 2.2.2 Comparative Analysis

- Studies reporting positive health effects of coffee were compared with studies highlighting potential risks to identify gaps and contradictions in existing research.
- Statistical data from meta-analyses and cohort studies were examined to determine patterns in coffee consumption and health outcomes.
- Industrial applications were reviewed by assessing emerging trends in coffee waste management and sustainable development.

## 2.3 Ethical Considerations

As this study is based on a review of publicly available literature, no human or animal subjects were involved. All sources used were cited appropriately to maintain academic integrity and avoid plagiarism.

## 2.4 Limitations of this study

- Potential publication bias in available studies, as positive effects of coffee may be more frequently reported than negative outcomes.
- The review is limited to English-language publications, potentially excluding relevant studies in other languages.
- Differences in study methodologies (e.g., variations in coffee consumption levels, participant demographics) may influence findings

## 3.0 Varieties of coffee existing worldwide

The taxonomy of coffee can be complex due to the presence of numerous species, cultivars, and hybrids, but the main species of interest are:

- *Coffea arabica* (Arabica coffee): This species accounts for approximately 60-70% of the world's coffee production. Arabica coffee is known for its higher quality and smoother taste, with a range of flavor profiles that can vary greatly depending on the growing conditions.
- *Coffea canephora* (Robusta coffee): Robusta coffee is typically considered to be of lower quality, producing a more rancorous, stronger cup with higher caffeine content than Arabica. It is used more in espresso blends and instant coffee, and it is known for its resilience to pests and diseases, particularly *Hemileia vastatrix* (coffee leaf rust).
- Other species: Less common species, such as *Coffea liberica* and *Coffea excelsa*, are also cultivated in certain regions but have less economic importance than Arabica and Robusta. These species offer distinctive flavor profiles and are grown primarily in specific areas of the world.

### 3.1 Proximate, Phytochemical and Mineral contents of Coffee

Coffee provides minimal macronutrients but is a significant source of bioactive micronutrients. It contains small amounts of vitamins such as niacin (B3) and minerals including potassium and magnesium, which play essential roles in metabolic and cardiovascular health (Pérez-Hernández *et al.*, 2022). Additionally, the antioxidant capacity of coffee, primarily attributed to its polyphenols, contributes to its health-promoting properties by reducing oxidative damage at the cellular level (Poole *et al.*, 2017). The beans also contain several components that contribute to both its flavor and its health effects. Here's a deeper look into the proximate, phytochemical, and mineral composition of coffee:

#### 3.1.0 Proximate Composition

- Water: Raw coffee beans contain around 10-12% water content, which affects the roasting process and flavor development.
- Proteins: Coffee beans contain about 10-15% protein, which contributes to the Maillard reaction during roasting, creating complex flavors and aromas.
- Lipids: Coffee beans contain about 10-15% lipids, which include triglycerides and diterpenes (cafestol and kahweol). These lipids are largely responsible for the viscosity and mouthfeel of the coffee, as well as the flavor profile.
- Carbohydrates: Coffee beans also contain carbohydrates, primarily in the form of cellulose and other polysaccharides.

These carbohydrates contribute to the formation of sugars and caramelization during roasting.

### 3.1.1 Phytochemicals Components

- **Caffeine:** Caffeine is the most well-known phytochemical in coffee, contributing to its stimulating effects. It also has several potential health benefits, including improving cognitive function and enhancing physical performance. The caffeine content of coffee varies but typically ranges from 70 to 140 mg per 8 oz cup, depending on the coffee variety and brewing method.
- **Chlorogenic Acids (CGAs):** Chlorogenic acids are the most abundant antioxidants in coffee, making up about 8-12% of the dry weight of the coffee bean. These polyphenolic compounds have been studied for their potential anti-inflammatory, anti-cancer, and anti-diabetic properties (Ribeiro *et al.*, 2018).
- **Diterpenes:** Cafestol and kahweol, the diterpenes in coffee, are linked to both positive and negative health outcomes. They have antioxidant properties but may also raise cholesterol levels if consumed in high amounts, especially when coffee is prepared using methods like French press or espresso.

### 3.1.2 Mineral Composition

Coffee is a source of several essential minerals, including potassium, magnesium, and calcium (Bermudez *et al.*, 2020).

- **Potassium:** Potassium plays a role in regulating fluid balance and blood pressure, making coffee a good source of this vital nutrient.
- **Magnesium,** important for muscle and nerve function, is also found in significant quantities in coffee beans (Bermudez *et al.*, 2020).

### 3.1.3 Chemical Composition and Bioactive Compounds in Coffee

- Coffee is rich in bioactive compounds that contribute to its physiological effects. The most well-known of these is caffeine, a natural stimulant that influences the central nervous system (Pérez-Hernández *et al.*, 2022). Caffeine acts by blocking adenosine receptors, thereby reducing fatigue and enhancing cognitive function (Cornelis, 2019b).
- Apart from caffeine, coffee contains polyphenols, including chlorogenic acids, which exhibit strong antioxidant and anti-inflammatory properties (Poole *et al.*, 2017). These compounds contribute to the reduction of oxidative stress, which is associated with chronic diseases such as cardiovascular disease, diabetes, and cancer (Grosso *et al.*, 2017). Additionally, diterpenes such as cafestol and kahweol, found in unfiltered coffee, have been studied for their potential hepatoprotective effects and anti-carcinogenic properties (Nieber, 2017). However, they may also influence cholesterol levels when consumed in excess (Poole *et al.*, 2017).

## 4.0 The benefits and risks of frequent coffee consumption

This section presents and discusses the key findings from the reviewed literature on the pharmacological, nutritional, medicinal, and industrial

applications of coffee. It highlights coffee's health benefits, industrial uses, and associated risks, providing a balanced perspective based on existing scientific evidence. Coffee is one of the most widely studied beverages due to its complex chemical composition and its significant effects on human health. Research has explored coffee's pharmacological, nutritional, medicinal, and industrial applications, as well as its potential health benefits and risks. This section provides an in-depth review of existing literature on coffee's bioactive compounds, physiological effects, and commercial significance.

### 4.1 Medicinal benefits of coffee

The reviewed studies confirm that coffee is a complex beverage containing numerous bioactive compounds, including caffeine, polyphenols (chlorogenic acids), diterpenes (cafestol and kahweol), and essential micronutrients (Pérez-Hernández *et al.*, 2022). These compounds contribute to coffee's physiological effects, including antioxidant, anti-inflammatory, and neuroprotective properties (Grosso *et al.*, 2017).

- **Caffeine:** The primary stimulant in coffee, caffeine blocks adenosine receptors, reducing fatigue and improving cognitive function (Cornelis, 2019a).
- **Chlorogenic Acids:** These polyphenols exhibit antioxidant activity, reducing oxidative stress and inflammation (Poole *et al.*, 2017). It also improves insulin sensitivity and reduce the risk of type 2 diabetes (Grosso *et al.*, 2017).
- **Diterpenes:** Found in unfiltered coffee, cafestol and kahweol have hepatoprotective properties but may raise cholesterol levels (Nieber, 2017).
- **Neurological and Cognitive Effects:** Numerous studies support coffee's role in cognitive enhancement and neuroprotection. Caffeine improves alertness, retentive memory, and reaction times, while long-term coffee consumption has been linked to a reduced risk of neurodegenerative diseases such as Alzheimer's and Parkinson's disease by modulating neurotransmitter activity and reducing oxidative stress (Pérez-Hernández *et al.*, 2022). Furthermore, habitual coffee consumption has been associated with improved memory, focus, and mood regulation (Cornelis, 2019a).
- A meta-analysis by Cornelis (2019a) found that moderate coffee intake (3–5 cups/day) was associated with a 25% reduced risk of Alzheimer's disease.
- Parkinson's disease risk was shown to decrease with regular caffeine consumption, likely due to its effect on dopamine regulation (Grosso *et al.*, 2017).
- Coffee is linked to a reduced risk of stroke and coronary artery disease in moderate consumers (Poole *et al.*, 2017).
- **Liver Protection:** Coffee consumption has been linked to a lower risk of liver diseases, including non-alcoholic fatty liver disease (NAFLD), cirrhosis, and hepatocellular carcinoma (Grosso *et al.*, 2017). A study by Poole *et al.* (2017) found that consuming 2–3 cups per day was associated with a 40% reduced risk of liver cirrhosis.



- Cardiovascular and Metabolic Health: The relationship between coffee and cardiovascular health remains complex. While moderate coffee intake has been linked to reduced risks of stroke and coronary artery disease, excessive consumption may lead to transient increases in blood pressure, particularly in caffeine-sensitive individuals (Poole *et al.*, 2017). Research also indicates that coffee may improve insulin sensitivity and lower the risk of type 2 diabetes due to its chlorogenic acid content (Grosso *et al.*, 2017).
- Anti-Inflammatory and Liver Health Benefits: Several studies highlight coffee's anti-inflammatory properties, which contribute to its potential role in reducing the risk of chronic diseases. Coffee consumption has been associated with lower levels of inflammatory markers such as C-reactive protein (Nieber, 2017). Additionally, coffee appears to have a protective effect on liver health, reducing the risk of conditions such as non-alcoholic fatty liver disease (NAFLD), cirrhosis, and hepatocellular carcinoma (Grosso *et al.*, 2017).

#### 4.2 Pharmacological, Industrial and Commercial Applications of Coffee

The industrial applications of coffee highlight its economic and environmental importance. Future research should focus on optimizing the sustainability of coffee by-products to reduce waste and enhance their commercial value. Beyond its traditional use as a beverage, coffee is increasingly utilized in pharmaceuticals and cosmetics. Some important industrial usage of coffee includes:

- Pharmaceuticals: Caffeine is widely used in pain relief medications and stimulants (Janissen and Huynh, 2018).
- Caffeine is commonly used in medications for migraine relief and in skincare products for its antioxidant and anti-inflammatory effects (Janissen and Huynh, 2018).
- Cosmetics: Coffee extracts are also incorporated into anti-aging creams, shampoos, and exfoliants due to their potential skin-protective, antioxidant and anti-inflammatory properties.
- Coffee plays a significant role in the pharmaceutical and cosmetic industries, contributing to products such as pain relievers, skincare, and energy supplements.
- Coffee by-products, including spent coffee grounds and husks, have emerging applications in biofuel production, composting, and sustainable materials.

#### 4.3 Health risks associated with frequent consumption of coffee

The chemical profile of coffee suggests both beneficial and potentially harmful effects, depending on consumption levels and individual health conditions. While caffeine and polyphenols contribute to neuroprotection and metabolic benefits, diterpenes in certain coffee preparations may pose risks for individuals with high cholesterol levels (Poole *et al.*, 2017). These findings suggest that coffee consumption could be a protective factor against age-related cognitive decline. However, individual sensitivity to caffeine varies, and excessive intake may lead to anxiety, restlessness, and sleep disturbances (Nieber, 2017). Some notable health risks associated with frequent intake of coffee include:

- Caffeine Dependence and Sleep Disruptions: One of the primary concerns regarding coffee consumption is caffeine dependence. Regular intake of high doses of caffeine can lead to withdrawal symptoms such as headaches, fatigue, and irritability (Cornelis, 2019a). Moreover, excessive caffeine consumption, particularly in the late afternoon or evening, has been associated with sleep disturbances, including insomnia and reduced sleep quality (Nieber, 2017). Excessive caffeine consumption can lead to dependence, withdrawal symptoms (Cornelis, 2019b). Sensitivity to caffeine varies, with some individuals experiencing restlessness, anxiety, and disrupted sleep cycles (Nieber, 2017).
- Gastrointestinal and Cardiovascular Risks: Coffee's acidity may exacerbate acid reflux and gastritis in some individuals (Poole *et al.*, 2017). Unfiltered coffee has been associated with increased cholesterol levels, necessitating caution for individuals with cardiovascular risks (Grosso *et al.*, 2017). Some individuals experience gastrointestinal discomfort due to the acidic nature of coffee, which may exacerbate conditions like acid reflux and gastritis. Additionally, while moderate coffee consumption appears to have cardiovascular benefits, excessive intake has been linked to temporary increases in heart rate and blood pressure, particularly in individuals with hypertension (Poole *et al.*, 2017).
- Pregnancy and Fertility Considerations: High caffeine intake during pregnancy has been linked to low birth weight and increased miscarriage risk (Grosso *et al.*, 2017). Health organizations recommend limiting caffeine intake to  $\leq 200$  mg/day during pregnancy (Cornelis, 2019a).
- Bioaccumulation of Caffeine: High level of caffeine may cause temporary increases in blood pressure, particularly in non-habitual drinkers (Cornelis, 2019a).
- Unfiltered coffee (e.g., French press, espresso) contains diterpenes that may increase cholesterol levels, posing a risk for individuals with cardiovascular conditions (Nieber, 2017).

These findings suggest that coffee can play a role in liver disease prevention and inflammation control. However, excessive intake may lead to gastrointestinal discomfort and other metabolic disturbances (Cornelis, 2019b).

#### 4.4 Coffee Waste Management and Sustainability

The coffee industry generates large amounts of by-products, including coffee pulp, husks, and spent coffee grounds. The valorization of coffee waste aligns with global sustainability efforts and the circular economy model (Janissen and Huynh, 2018). Research is focusing on repurposing these waste materials for sustainable applications.

- The coffee industry generates large amounts of waste, but emerging research suggests sustainable applications for coffee by-products.
- Spent Coffee Grounds: Used for biofuels, compost, production of natural dyes and biodegradable materials (Janissen and Huynh, 2018).
- Coffee Husks and Pulp: Repurposed for animal feed and organic fertilizers.

## Recommendations

- The existing literature provides substantial evidence regarding coffee's pharmacological, nutritional, medicinal, and industrial significance. While moderate coffee consumption is generally considered beneficial, excessive intake poses potential health risks. Additionally, emerging research on coffee by-products highlights promising industrial applications, though further studies are needed to optimize their sustainability and commercial viability.
- Future research should focus on long-term clinical studies to better understand coffee's health effects across different populations. Additionally, further exploration of coffee's bioactive compounds and their potential pharmaceutical applications could enhance its role in preventive medicine.
- More studies are needed to establish personalized coffee consumption guidelines based on genetic, metabolic, and lifestyle factors.
- Long-term research should further investigate coffee's role in chronic disease prevention and cardiovascular health.
- Sustainable innovations in coffee waste management and eco-friendly applications should be explored to enhance the environmental impact of the coffee industry.
- Explore long-term health effects of coffee in diverse populations.
- Investigate optimal coffee consumption levels for health benefits.
- Develop sustainable methods for coffee by-product utilization

## Conclusion

When consumed in moderation, coffee is a functional beverage with significant health-promoting properties. However, its effects vary based on individual health status, preparation methods, and consumption levels. By promoting responsible coffee consumption and sustainable industry practices, the potential benefits of coffee can be maximized while mitigating associated risks. Moderate coffee consumption appears beneficial for cardiovascular and metabolic health, but individuals with hypertension or high cholesterol may need to limit unfiltered coffee intake (Poole *et al.*, 2017). Further research is needed to clarify the long-term cardiovascular effects of different coffee preparations. While coffee is generally safe for most individuals, excessive intake can lead to health risks. Personalized recommendations based on individual tolerance and medical conditions are essential. Coffee is a globally consumed beverage with diverse pharmacological, nutritional, medicinal, and industrial

applications. The findings from this review highlight both its health benefits and potential risks, emphasizing the need for a balanced and personalized approach to consumption.

## References

1. Bermúdez-Florez, L. N., Cartagena-Valenzuela, J. R., Ramírez-Builes, V. H. (2020). Soil humidity and evapotranspiration under three coffee (*Coffea arabica* L.) planting densities at Naranjal experimental station (Chinchiná, Caldas, Colombia). *Acta Agronomy*. 67: 402–413. <https://doi.org/10.15446/acag.v67n3.67377>
2. Brito, L. B., Riet-Correa, F., Almeida, V. M., Silva, G. B., Chaves, H. A. S. et al. (2019). Spontaneous poisoning by *Ricinus communis* leaves (Euphorbiaceae) in goats. *Pesqui. Vet. Bras*. 39(2): 123-128
3. Cornelis, M. C. (2019). The impact of caffeine and coffee on human health. *Nutrients*. 11(2): 416.
4. Cornelis, M. C. (2019). Coffee and health: Genetic variation, consumption, and disease risk. *Annual Review of Nutrition*. 39(1): 131–156. <https://doi.org/10.1146/annurev-nutr-082018-124603>
5. Grosso, G., Godos, J., Galvano, F., Giovannucci, E. L. (2017). Coffee, caffeine, and health outcomes: an umbrella review. *Annual Review of Nutrition*. 37: 131-156.
6. Hernandez, M. A., Ibarra, R., Trupkin, D. R., (2014). How far do shocks move across borders? Examining volatility transmission in major agricultural futures markets. *European Review of Agricultural Economics*. 41(2): 301-325.
7. Janissen, B., and Huynh, T. (2018). Sustainability of coffee production and consumption. *Environmental Science and Policy*. <https://doi.org/10.1016/j.envsci.2018.04.011>. 85: 69–75.
8. Nieber, K. (2017). The impact of coffee on health. *Planta Medica*. 83(16): 1256-1263.
9. Pérez-Hernández, L. M., Cardoso-Saldaña, G. C., Anaya-Esparza, L. M. (2022). Coffee bioactive compounds: A review on their health-promoting properties. *International Journal of Molecular Sciences*. 23(1): 400.
10. Pérez-Hernández, L. M., Chávez-Quiroz, K., Serna-Saldívar, S. O. (2022). Coffee as a functional beverage: Bioactive compounds, health benefits, and safety considerations. *Food Research International*. 157: 111386. <https://doi.org/10.1016/j.foodres.2022.111386>
11. Poole, R., Kennedy, O. J., Roderick, P., Fallowfield, J. A., Hayes, P. C. et al. (2017). Coffee consumption and health: umbrella review of meta-analyses of multiple health outcomes. *BMJ*. 359: j5024.



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