

BIOACTIVE COMPOUNDS OF COFFEE. HEALTH CLAIMS AND OPTIMIZED CONSUMPTION

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Introduction

Cafestol and kahweol (C&K) are natural diterpenes extracted from coffee beans that showed multiple potential pharmacological activities such as anti-inflammatory, antiangiogenic, and antitumorigenic. Up to now, studies show that C&K are the only bioactive compounds in coffee that have significant antitumor activity in specific cancer cell lines. The most relevant mechanisms involved are down-regulating inflammation mediators, increasing glutathione, inducing apoptosis of tumour cells and anti-angiogenesis. In addition, the two coffee diterpenes can prevent cancer from occurring by blocking the activation of carcinogens and improving liver detoxification function. However, they also have the negative effect of raising serum lipid, raising LDL and total cholesterol, constituting a potential risk of inducing cardiovascular diseases (Ren *et al.*, 2019).

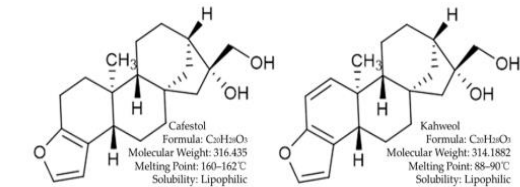


Figure 1. Structure and chemical characteristics of cafestol and kahweol. They are natural diterpenes extracted from coffee beans.

Activities	Mechanism of action	Comparison of efficiency
Raising serum lipid	Down regulate LDL receptor and increase plasma lipid transfer proteins levels (CETP, PLTP).	Cafestol stronger than kahweol.
Anti-inflammation	- Inhibit the expression of iNOS and COX-2 and the secretion of pro-inflammatory cytokines. - Inhibit phase I and induce phase II detoxifying enzymes.	Kahweol more effective
Anti-carcinogenesis	- Induce apoptosis - Anti-angiogenesis	Kahweol stronger anti-angiogenic
Anti-diabetes	- Increase insulin secretion and glucose uptake in muscle cells - Inhibit adipogenesis.	Not mentioned.
Anti-osteoclastogenesis	- Inhibit differentiation and bone resorbing activity of OCs. - Promote OBs differentiation.	Kahweol stronger

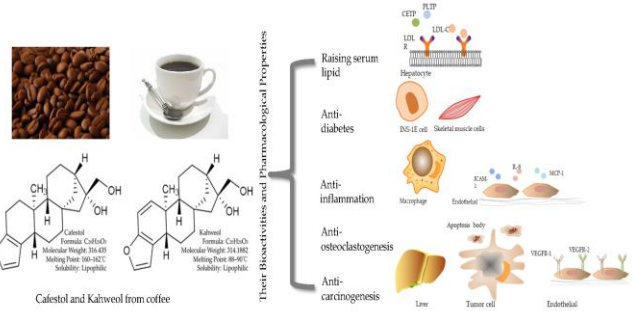


Figure 2: Effects and pharmacological activities of cafestol and kahweol (Ren *et al.*, 2019).

Brew Method	Cafestol (mg/cup)	Kahweol (mg/cup)
Boiled/Turkih	3–7	3–7
French Press	3–4	3–4
Espresso/Capsule	1–2	1–2
Drip/Filter/Instant	<0.1–0.8	<0.1–0.4

Figure 3: Comparison of diterpene content by brewing method.

Materials/Methods

The type of coffee brewing originates very different amounts of C&K, namely filtration procedures considerably lower their amounts when compared with espresso coffee, moka or Turkish style coffee, so damaging effects on blood lipids can be prevented with the use of some kind of filter.

The findings suggest that these compounds are present in the coffee cup as part of the suspended solids, and that filtration, pressurization, and coffee powder particle size are crucial parameters influencing their concentrations.

The growing coffee capsules consumption can also be assisted technological to partially eliminate these compounds if desirable. Compostable capsules also can reduce their content in the brew.



Results/Discussion



- Arabic coffee have higher content of C&K.
- Unfiltered brewing methods produce coffee with high concentrations of C&K, whereas paper-filtered methods result in significantly lower concentrations. Paper filter quality and porosity further reduce diterpene content; more porous filters allow higher levels.
- Paper filters inside capsules enable best distribution of water and extraction and gives a cleaner cup, cream, lighter mouthfeel and healthier content in C&K but can remove natural oils that add flavor and aroma.

Conclusion/Perspectives

Brewing method strongly influences cafestol and kahweol levels in coffee. The type of coffee brew or machine extraction method has a major impact on the levels of these two diterpenes, linked to both health benefits and increased cholesterol, in the final cup. The use of intermediate or inferior paper filters in capsules trap coffee oils (diterpenes) linked to cholesterol, especially useful for reducing them in arabic coffees for consumers with colesterol issues, but can limit other health benefits.

References:

Santanatoglia *et al.*, (2025) *Journal of Food Composition and Analysis* 137:106929;
Ren *et al.*, 2019 (2019) *Int. J. Mol. Sci.* 20:4238.