DERLEME REVIEW

DOI: 10.5336/dermato.2019-66044

# Coffee and Skin: What do We Know About it?

## Kahve ve Deri: Hakkında Ne Biliyoruz?

Ahu YORULMAZ[a]

[a]Clinic of Dermatology, Ankara Numune Training and Research Hospital, Ankara, TURKEY

*Received:* 14.03.2019
*Accepted:* 05.04.2019
*Available online*: 09.04.2019

*Correspondence:*
Ahu YORULMAZ
Ankara Numune Training and Research Hospital, Clinic of Dermatology, Ankara, TURKEY/TÜRKİYE
ahuyor@gmail.com

**ABSTRACT** Coffee is one of the world's most popular drinks. It is only an inspirational morning refreshment for some, but for others it has become a lifestyle beverage with a global consumption of billions cups per day. Because of its popularity, coffee has often been proposed to be able to prevent health problems and has attracted a great deal of research over the years. Although there has been limited research evaluating the effectiveness of coffee in ameliorating certain health conditions, there is a compelling evidence that coffee consumption has potential benefits for a variety of chronic diseases. Recent studies have confirmed that moderate amount of coffee consumption might have a role in protection against type 2 diabetes, metabolic syndrome, Parkinson's disease, Alzheimer's disease, depression, cognitive impairment, chronic liver disease, chronic kidney disease, prostate cancer, endometrial cancer, liver cancer, leukemia and cardiovascular diseases, including hypertension, coronary heart disease and venous thromboembolism. In dermatological point of view, currently there is a growing body of evidence suggesting that caffeine and other nutrients contained in coffee may protect against melanoma and non-melanoma skin cancer. Moreover, as the new data on coffee and health continues to get emerged, it is getting clear that coffee is also effective in inflammatory disease prevention, including inflammatory skin diseases. In this review, we focused on recent evidence about coffee and dermatological diseases and aimed to explore the link between coffee and melanoma/ non-melanoma skin cancers, psoriasis and rosacea.

**Keywords:** Coffee; melanoma; non-melanoma skin cancer; psoriasis; rosacea

**ÖZET** Kahve dünyada en fazla tüketilen içecekler arasında yer alır. Kahve bazıları için sadece bir sabah uyaranı olabilir, ancak bazıları içinse günlük global tüketimi milyarlarla ölçülen bir hayat tarzı içeceğidir. Popularitesi nedeniyle, kahvenin sıklıkla sağlık problemlerini önlediği ileri sürülmüş ve kahve yıllar içerisinde çok sayıda araştırmanın başlıca konularından biri olmuştur. Her ne kadar, kahvenin bazı hastalıkları iyileştirmesindeki etkinliği ile ilgili ortaya konmuş yeterli veri yoksa da, günümüzde kahvenin çok sayıda kronik hastalığın önlenmesinde faydalı olduğunu gösteren kayda değer veriler bulunmaktadır. Son yıllarda yapılan çalışmalar, makul düzeyde kahve tüketiminin tip 2 diyabet, metabolik sendrom, Parkinson hastalığı, Alzheimer hastalığı, depresyon, kognitif bozukluklar, kronik karaciğer hastalığı, kronik böbrek hastalığı, prostat kanseri, endometrium kanseri, karaciğer kanseri, lösemi ve hipertansiyon, koroner arter hastalığı ve venöz tromboembolizmi de içeren kardiyovasküler hastalıklara karşı koruyucu rol oynayabileceğini göstermiştir. Dermatolojik açıdansa, kahvede bulunan kafein ve diğer bileşenlerin melanoma ve melanom dışı deri kanserlerine karşı koruyucu olduğunu gösteren veriler gün geçtikçe artmaktadır. Dahası, kahve ve sağlıkla ilgili yeni veriler ortaya çıktıkça, kahvenin inflamatuar deri hastalıkları da dahil olmak üzere, inflamatuar hastalıkların önlenmesinde etkili olduğu daha anlaşılır düzeye ulaşmış bulunmaktadır. Bu derlemede, kahve ve deri hastalıkları ile ilgili güncel literatüre odaklandık ve kahve ile melanom, melanom dışı deri kanseri, psöriazis ve rozaseanın ilişkisini irdelemeyi hedefledik.

**Anahtar Kelimeler:** Kahve; melanom; melanom dışı deri kanseri; psöriazis; rozasea

Coffee, one of the most widely consumed beverages worldwide, can trace its heritage back to the eighth century AD.[1,2] Before it was commonly consumed on a daily basis, coffee had been used for medicinal purposes and regarded as a luxurious drink feasible only to upper-class.[3] Coffee intake varies according to lifestyle and demographic factors.[4] Lastly it has been reported that over 2.5 billion cups of coffee are consumed world-

wide each day.[5] Coffee literally has potential implications on human health and some debates exist regarding the association of coffee consumption with certain health conditions. Recent studies have shown that coffee decreases the risk of metabolic syndrome, type 2 diabetes, Alzheimer's disease, Parkinson's disease, gallstone disease, prostate cancer, endometrial cancer, liver cancer, leukemia, cirrhosis, gout, renal stones and depression and reduces overall mortality (Table 1). On the other hand, there are studies describing a possible association between coffee consumption and increased risk of lung cancer, laryngeal cancer, gastric cancer, endometriosis, rheumatoid arthritis and fracture in women (Table 2).[1,2,5-10]

Coffee contains a wide array of compounds, including the major component, caffeine. Caffeine is well-known to be associated with a range of physiological effects, specifically on cardiovascular system. Since caffeine has the ability to increase blood pressure, coffee intake has been captured attention with safety concerns about cardiovascular-related risks. Nevertheless, contemporary studies have revealed that caffeine intake lowers the overall mortality from all causes of cardiovascular disease rather than increasing it. Beneficial or noxious associations of coffee intake seem to vary between health outcomes of interest. Though, there is a presumed evidence of coffee intake has favorable effects for a variety of conditions.[1,2,5-10] In this review, we will outline contemporary evidence-based knowledge in the context of association of coffee with dermatological diseases, in particular, melanoma/non-melanoma skin cancers, psoriasis and rosacea.

**TABLE 1:** Some beneficial health outcomes of coffee consumption.

| |
|---|
| Lowers risk of type 2 diabetes/ metabolic syndrome |
| Reduces risk of Parkinson's disease |
| Protects against cirrhosis/ chronic liver disease/ gallstones |
| Protects against chronic kidney disease/ renal stones |
| Decreases risk of liver cancer |
| Decreases risk of endometrial cancer |
| Lowers risk of leukemia |
| Reduces risk of prostate cancer |
| Decreases risk of depression |
| Reduces mortality |

**TABLE 2:** Some harmful associations of drinking coffee.

| |
|---|
| Increases risk of lung cancer |
| Increases risk of fracture in women |
| Increases rik of laryngeal cancer |
| Increases risk of rheumatoid arthritis |
| Increases risk of gastric cancer |
| Increases risk of endometriosis |

## THE MAJOR COMPOUND OF COFFEE: CAFFEINE

Regarded as the most widely consumed psychoactive drug in the world, caffeine, naturally found in leaves or beans of coffee and tea, also in cocoa beans. Caffeine can provide a boost in alertness/ mood and counteract feelings of "low-energy". Caffeine is a methylxanthine, of which primary mechanisms of action have been defined as antagonism at the level of adenosine receptors and inhibition of phosphodiesterases. Adenosine is an important biological mediator and adenosine receptors are expressed throughout the body. Via antagonizing adenosine receptors, caffeine increases plasma concentration of circulating catecholamines, which consequently results in increased peripheral resistance and raised blood pressure.[11-13]

## POTENTIAL ANTI-CARCINOGENIC EFFECTS OF CAFFEINE

There is a growing literature indicating that caffeine may protect against melanoma and non-melanoma skin cancers.[14-26] In coffee, although there are other potential anticancer ingredients other than caffeine, caffeine is one of the mostly researched compounds in chemopreventive power of coffee. Caffeine exerts its antiproliferative and anti-carcinogenic action via regulating cell growth, development and apoptosis. It has been shown that caffeine has sunscreen effect, reduces sunburn lesions in the epidermis and inhibits ultraviolet (UV)-induced carcinogenesis by suppressing formation of thymine dimers. Caffeine increases elimination of damaged precancerous cells and

apoptosis in tumors. Caffeine modulates cell cycle and increases UV-induced apoptosis through p53-dependent and p53-independent biological pathways. Data from recent studies have revealed an inhibitory effect of caffeine on the proliferation of both melanoma and nonmelanoma cell lines.[14-26]

## THE MIRACLE OF COFFEE POLYPHENOLS: THE LINK BETWEEN POLYPHENOLS AND SKIN CANCER

The anti-carcinogenic potential of coffee in skin cancer is not only linked with caffeine. Dietary polyphenols contained in coffee are known to inhibit carcinogenesis because they have antioxidant and anti-inflammatory properties. Coffee is known to contain a diverse kind of chemicals, including carbohydrates, lipids, vitamins, minerals, nitrogenous and phenolic compounds. The main polyphenols in coffee are phenolic acids (i.e., chlorogenic acids) and flavonoids (i.e., catechins). A certain amount of evidence exists regarding the consumption of polyphenols has the potential to protect against various oxidative-stress related diseases. Polyphenols decrease oxidative stress by trapping free radicals. Recent studies have shown that the coffee bioactives enhance glutathione levels and offer protection against DNA damage. Moreover, beside their antioxidant activity, polyphenols are known to inhibit carcinogenesis by inhibiting cyclooxygenase-2 (COX-2). Polyphenols modulate the activity of arachidonic acid metabolizing enzymes including, COX. It has been demonstrated that polyphenols suppresses UVB-induced COX-2 expression and prostaglandin E2 levels.[6,14,18,19,26-29]

## CAFFEINE, POLYPHENOLS AND PSORIASIS

Other than protection against UV-induced carcinogenesis, the potential preventive effects of polyphenols against inflammatory skin diseases has also raised great interest in recent years. A diet rich in polyphenols is known to be associated with reduced risk of developing chronic inflammatory diseases. Psoriasis shares immunologic features with other human autoimmune inflammatory conditions. Recent studies have offered support that polyphenols may modulate inflammatory mediators and cell-mediated immunity responses in psoriatic patients, since they have anti-inflammatory, antioxidant and immunomodulatory effects. Coffee reduces the levels of interleukin (IL)-1β, IL-6, tumor necrosis factor (TNF)-α and C-reactive protein (CRP) levels while increasing anti-inflammatory markers, including adiponectin, IL-4 and IL-10 levels. One of the most important polyphenols, chlorogenic acid, exerts strong anti-inflammatory effects via inhibiting COX-2/ Nuclear factor-kappaB pathway, consequently inhibiting pro-inflammatory mediators synthesis and release, especially TNF-α, IL-1β, IL-6 and interferon (IFN)-γ). Moreover, another polyphenol, caffeic acid, also known to inhibit inflammation by decreasing nitrite levels.[30-32]

The link between coffee and psoriasis is not only based on the anti-inflammatory effects of polyphenols. Caffeine is also known to have immunomodulatory and anti-inflammatory properties. The role of caffeine in immunosuppression has been defined as the suppression of the release of pro-inflammatory cytokines and Th1/Th2 cell proliferation. Caffeine reduces the migration of monocytes and neutrophils. It has been shown that higher caffeine consumption was associated with reduced inflammasome activation. Caffeine increases the release of anti-inflammatory cytokines including IL-10 and decreases the release of pro-inflammatory cytokines including TNF-α, IL-2 and IFN-γ. Caffeine is an adenosine receptor antagonist inhibiting phosphodiesterases. Caffeine administration increases Cyclic Adenosine MonoPhosphate (cAMP) levels, which also has immunomodulatory properties, since it is known to increase the release of anti-inflammatory cytokines and immune cells.[32,33]

## COFFEE FOR ROSACEA: THE GOOD OR THE BAD?

Other than caffeine and polyphenols, coffee also contains numerous components that may also contribute towards its antioxidant, immunomodulatory and anti-inflammatory effects.[6] However,

there is not any solid data so far about the preventive potential of other components of coffee against further skin diseases. Rosacea represents a dilemma among dermatological diseases in that it tends to be aggravated with coffee consumption. Until recent years, the aggravating potential of coffee in rosacea has been linked with the thermal heat of the beverages.[34,35] On the other hand, there has been a growing debate about whether the caffeine or the temperature of the coffee is the actual culprit for exacerbation of rosacea.[34-36] The fact that increased risk of rosacea is also linked with caffeine containing beverages that are lukewarm or cool in temperature, has brought the idea of the association of caffeine and rosacea is not only heat related.[36] Moreover, paradoxically, in a recent study it has been shown that increased caffeine intake from coffee is conversely associated with the risk of rosacea in women.[37]

Caffeine is a methylxanthine, which increases intracellular calcium stimulating the production of nitric oxide (NO). NO is a mediator of vasodilation in blood vessels. Caffeine is an adenosine receptor antagonist, affects cAMP levels by inhibiting phosphodiesterases. Administration of caffeine results in an accumulation of cAMP and vasodilation. Caffeine plays a central role in activation of sympathetic nerves and mediation of skin vasodilatation. Increased sympathetic excitability and vasodilatation are assumed to be implicated in the development of flushing and subcutaneous telangiectasia in rosacea.[34-36,39]

The pathogenesis of rosacea still remains unclear. Abnormal neurovascular signaling is presumed to be one of the key constituents of the pathogenesis. But other than neurovascular dysfunction, neurogenic inflammation, a condition induced by sensory nerves via antidromically released neuromediators, represents a prominent etiological factor in rosacea development.[39,40] The conflicting results from large population-based studies have led to reconsideration of limiting of caffeine intake in rosacea.[36,37] Components in coffee are known to have potent antioxidant, anti-inflammatory and immunomodulatory effetcs. It is still under consideration whether coffee has the potential to ameliorate the symptoms of rosacea.[36,37]

## CONCLUSION

There are evident effects of coffee on human physiology in that it contains thousands of bioactive components. Moreover, it is known that some of these constituents have the potential to produce unique health effects that could be different to effects of the same constituent from other sources.[1] Over the years, conflicting findings and concerns have arisen from the studies investigating association of coffee intake with certain health conditions. Until now, studies oftenly focused on the mostly well-known components of coffee. Some components, for instance, caffeine and polyphenols, both have antioxidant, immunomodulatory and anti-inflammatory effects. Therefore, these biochemical ingredients display additive action in regard to chemoprevention of diseases. However, due to the myriad of compounds, coffee may have both health promoting but, in some circumstances, undesirable effects to health.[1,2,5-10] Not only large-scale population based studies, but also biological and molecular studies are needed to assess the potential benefits and impact of coffee intake on human health.

### *Source of Finance*

*During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.*

### *Conflict of Interest*

*No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.*

### *Authorship Contributions*

*This study is entirely author's own work and no other author contribution.*

## REFERENCES


1. Poole R, Kennedy OJ, Roderick P, Fallowfield JA, Hayes PC, Parkes J. Coffee consumption and health: umbrella review of meta-analyses of multiple health outcomes. BMJ. 2017;359:j5024. [Crossref]
2. Whayne TF Jr. Coffee: a selected overview of beneficial or harmful effects on the cardiovascular system? Curr Vasc Pharmacol. 2015;13(5):637-48. [Crossref]
3. Fredholm BB. Notes on the history of caffeine use. Handb Exp Pharmacol. 2011;1(200):1-9. [Crossref] [PubMed]
4. Loftfield E, Freedman ND, Dodd KW, Vogtmann E, Xiao Q, Sinha R, et al. Coffee drinking is widespread in the United States, but usual intake varies by key demographicand lifestyle factors. J Nutr. 2016;146(9):1762-8. [Crossref] [PubMed] [PMC]
5. Weisse AB. Coffee: grounds for concern? Proc (Bayl Univ Med Cent). 2015;28(1):122-3. [Crossref]
6. Bae JH, Park JH, Im SS, Song DK. Coffee and health. Integr Med Res. 2014;3(4):189-91. [Crossref] [PubMed] [PMC]
7. Grosso G, Godos J, Galvano F, Giovannucci EL. Coffee, caffeine, and health outcomes: an umbrella review. Annu Rev Nutr. 2017;37:131-56. [Crossref] [PubMed]
8. Cano-Marquina A, Tarín JJ, Cano A. The impact of coffee on health. Maturitas. 2013;75(1):7-21. [Crossref] [PubMed]
9. Nieber K. The impact of coffee on health. Planta Med. 2017;83(16):1256-63. [Crossref] [PubMed]
10. Alicandro G, Tavani A, La Vecchia C. Coffee and cancer risk: a summary overview. Eur J Cancer Prev. 2017;26(5):424-32. [Crossref] [PubMed]
11. Temple JL, Bernard C, Lipshultz SE, Czachor JD, Westphal JA, Mestre MA. The safety of ingested caffeine: a comprehensive review. Front Psychiatry. 2017;8(1):80. [Crossref] [PubMed] [PMC]
12. Franco R, Oñatibia-Astibia A, Martínez-Pinilla E. Health benefits of methylxanthines in cacao and chocolate. Nutrients. 2013;5(10):4159-73. [Crossref] [PubMed] [PMC]
13. Spaeth AM, Goel N, Dinges DF. Cumulative neurobehavioral and physiological effects of chronic caffeine intake: individual differences and implications for the use of caffeinated energy products. Nutr Rev. 2014;72 Suppl 1:34-47. [Crossref]
14. Caini S, Cattaruzza MS, Bendinelli B, Tosti G, Masala G, Gnagnarella P, et al. Coffee, tea and caffeine intake and the risk of non-melanoma skin cancer: a review of the literature and meta-analysis. Eur J Nutr. 2017;56(1):1-12. [Crossref] [PubMed]
15. Wu S, Han J, Song F, Cho E, Gao X, Hunter DJ, et al. Caffeine intake, coffee consumption, and risk of cutaneous malignant melanoma. Epidemiology. 2015;26(6):898-908. [Crossref] [PubMed] [PMC]
16. Lukic M, Jareid M, Weiderpass E, Braaten T. Coffee consumption and the risk of malignant melanoma in the Norwegian Women and Cancer (NOWAC) Study. BMC Cancer. 2016;16:562. [Crossref] [PubMed] [PMC]
17. Conney AH, Lu YP, Lou YR, Kawasumi M, Nghiem P. Mechanisms of caffeine-induced inhibition of UVB carcinogenesis. Front Oncol. 2013;3:144. [Crossref] [PubMed] [PMC]
18. Loftfield E, Freedman ND, Graubard BI, Hollenbeck AR, Shebl FM, Mayne ST, et al. Coffee drinking and cutaneous melanoma risk in the NIH-AARP diet and health study. J Natl Cancer Inst. 2015;107(2). [Crossref]
19. Liu J, Shen B, Shi M, Cai J. Higher caffeinated coffee intake is associated with reduced malignant melanoma risk: a meta-analysis study. PLoS One. 2016;11(1):e0147056. [Crossref]
20. Ferrucci LM, Cartmel B, Molinaro AM, Leffell DJ, Bale AE, Mayne ST. Tea, coffee, and caffeine and early-onset basal cell carcinoma in a case-control study. Eur J Cancer Prev. 2014;23(4):296-302. [Crossref] [PubMed] [PMC]
21. Song F, Qureshi AA, Han J. Increased caffeine intake is associated with reduced risk of basal cell carcinoma of the skin. Cancer Res. 2012;72(13):3282-9. [Crossref] [PubMed]
22. Oh CC, Jin A, Yuan JM, Koh WP. Coffee, tea, caffeine, and risk of non-melanoma skin cancer in a Chinese population: The Singapore Chinese Health Study. J Am Acad Dermatol. 2019 Feb 4. [Epub ahead of print]. [Crossref]
23. Micek A, Godos J, Lafranconi A, Marranzano M, Pajak A. Caffeinated and decaffeinated coffee consumption and melanoma risk: a dose-response meta-analysis of prospective cohort studies. Int J Food Sci Nutr. 2018;69(4):417-26. [Crossref] [PubMed]
24. Wang J, Li X, Zhang D. Coffee consumption and the risk of cutaneous melanoma: a meta-analysis. Eur J Nutr. 2016;55(4):1317-29. [Crossref] [PubMed]
25. Vaseghi G, Haghjoo-Javanmard S, Naderi J, Eshraghi A, Mahdavi M, Mansourian M. Coffee consumption and risk of nonmelanoma skin cancer: a dose-response meta-analysis. Eur J Cancer Prev. 2018;27(2):164-70. [Crossref] [PubMed]
26. Fortes C, Mastroeni S, Boffetta P, Antonelli G, Pilla MA, Bottà G, et al. The protective effect of coffee consumption on cutaneous melanoma risk and the role of GSTM1 and GSTT1 polymorphisms. Cancer Causes Control. 2013;24(10):1779-87. [Crossref] [PubMed]
27. Kang NJ, Lee KW, Shin BJ, Jung SK, Hwang MK, Bode AM, et al. Caffeic acid, a phenolic phytochemical in coffee, directly inhibits Fyn kinase activity and UVB-induced COX-2 expression. Carcinogenesis. 2009;30(2):321-30. [Crossref] [PubMed] [PMC]
28. Wang Y, Ho CT. Polyphenolic chemistry of tea and coffee: a century of progress. J Agric Food Chem. 2009;57(18):8109-14. [Crossref] [PubMed]
29. Yamagata K. Do coffee polyphenols have a preventive action on metabolic syndrome associated endothelial dysfunctions? An assessment of the current evidence. Antioxidants (Basel). 2018;7(2). [Crossref]
30. Andújar I, Recio MC, Giner RM, Ríos JL. Cocoa polyphenols and their potential benefits for human health. Oxid Med Cell Longev. 2012;2012:906252. [Crossref] [PubMed] [PMC]
31. Działo M, Mierziak J, Korzun U, Preisner M, Szopa J, Kulma A. The potential of plant phenolics in prevention and therapy of skin disorders. Int J Mol Sci. 2016;17(2):160. [Crossref] [PubMed] [PMC]
32. Barrea L, Muscogiuri G, Di Somma C, Annunziata G, Megna M, Falco A, et al. Coffee consumption, metabolic syndrome and clinical severity of psoriasis: good or bad stuff? Arch Toxicol. 2018;92(5):1831-45. [Crossref] [PubMed]
33. Sharif K, Watad A, Bragazzi NL, Adawi M, Amital H, Shoenfeld Y. Coffee and autoimmunity: more than a mere hot beverage! Autoimmun Rev. 2017;16(7):712-21. [Crossref]
34. Clatici VG, Satolli F, Tatu AL, Voicu C, Draganita AMV, Lotti T. Butterfly effect-the concept and the ımplications in dermatology, acne, and rosacea. Maedica (Buchar). 2018;13(2):89-94.
35. Steinhoff M, Buddenkotte J, Aubert J, Sulk M, Novak P, Schwab VD, et al. Clinical, cellular, and molecular aspects in the pathophysiology of rosacea. J Investig Dermatol Symp Proc. 2011;15(1):2-11. [Crossref] [PubMed] [PMC]
36. Yuan X, Huang X, Wang B, Huang YX, Zhang YY, Tang Y, et al. Relationship between rosacea and dietary factors: a multicenter retrospective case-control survey. J Dermatol. 2019;46(3):219-25. [Crossref] [PubMed]
37. Li S, Chen ML, Drucker AM, Cho E, Geng H, Qureshi AA, et al. Association of caffeine intake and caffeinated coffee consumption with risk of incident rosacea in women. JAMA Dermatol. 2018;154(12):1394-400. [Crossref] [PubMed]
38. Echeverri D, Montes FR, Cabrera M, Galán A, Prieto A. Caffeine's vascular mechanisms of action. Int J Vasc Med. 2010;2010(1):834060. [Crossref]
39. Schwab VD, Sulk M, Seeliger S, Nowak P, Aubert J, Mess C, et al. Neurovascular and neuroimmune aspects in the pathophysiology of rosacea. J Investig Dermatol Symp Proc. 2011;15(1):53-62. [Crossref] [PubMed] [PMC]
40. Ahn CS, Huang WW. Rosacea pathogenesis. Dermatol Clin. 2018;36(2):81-6. [Crossref] [PubMed]