Derleme/Review

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The Effects of Coffee Consumption on Cardiovascular Heart Diseases and Other Diseases

Kahve Tüketiminin Kardiyovasküler Kalp Hastalıkları ve Diğer Hastalıklar Üzerine Etkileri

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ABSTRACT

Coffee is the most consumed drink in daily life after tea and water. Coffee has become an indispensable part of our sociocultural life. Most people start their day with coffee and finish with this. Coffee can be called superfood because it has many bioactive components, minerals and vitamins that affect human health. Therefore, coffee has attracted the attention of many researchers with its rich bioactive components and then studies about the effects of coffee on animal and human health have been realized. In this review, we aimed to investigate the effects of coffee on health, especially cardiovascular disease (CVD) and cardiovascular risk factors.

Keywords: Antioxidant, Bioactive Components, Cardiovascular Diseases, Coffee, Health

ÖZET

Kahve, çay ve sudan sonra günlük yaşamda en çok tüketilen içeceklerdir. Kahve, sosyokültürel yaşamımızın vazgeçilmez bir parçası haline gelmiştir.Çoğu insan güne kahve ile başlar ve kahveyle bitirir. Kahve süper besin olarak isimlendirilebilir çünkü insan sağlığını etkileyen birçok biyoaktif bileşeni, mineralleri ve vitaminleri vardır.Böylece kahve, zengin biyoaktif bileşenleri ile birçok araştırmacının dikkatini çekmiş ve ardından kahvenin hayvan ve insan sağlığı üzerindeki etkileri ile ilgili çalışmalar yapılmıştır.Bu derlemede kahvenin sağlığa, özellikle kardiyovasküler hastalıklar (CVD) ve kardiyovasküler risk faktörleri üzerine etkilerini irdelemeyi planladık.

Anahtar Kelimeler: Antioksidan, Biyoaktif Bileşenler, Kardiyovasküler Hastalıklar, Kahve, Sağlık

INTRODUCTION

Coffee is one of the most consumed drink on worldwide and it has taken important place in populations since at least 1200 years (Bonita et al., 2007). Countries where coffee is consumed mostly are Finland, Norway and Danmarkrespectively (ICO, 2016). Itis estimated that coffee consumption will increase as nontraditionally in Africa, Asia, and Oceania in many years and it is predicted that the request for coffee marketing will expand by 2.5% in North America and by 1% in Europe (ICO, 2018).

Coffee belongs to Rubiaceae family and it has two main type forms (*Coffea arabica L.* and *Coffea canephora*) that have originated from Ethiopia and in tropical Africa (ICO, 2016). The coffee is generally prepared by hot water and ground coffee but it can be consumed in different forms. It is drinked as espresso in Italy that is prepared by extracting finely ground powder with high-pressure hot water. In today, the coffe can be cooked by the coffee machine that hot water is forced up through the coffee to the top of the machine (Martini et al., 2016).

The coffee and bioactive components

Coffee is a complex mixture of chemical structures and it is the main source of caffeine (Figure 1). Also, it contains many different chemicals such as carbohydrates, lipids, nitrogenous compounds, vitamins, minerals, alkaloids and phenolic components (Spiller, 1984).

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The polyphenols are represented by chlorogenic acid and its components such as caffeine, caffeic acid, trigonelline, chlorogenic acid and diterpenes that have effects on human health (Frost-Meyer et al.,2012).

Caffeine: Caffeine (1,3,7-trimethylxanthine)is a purine alkaloid(Louarn et al., 2001).There is between 84 mg and 112 mg caffeine in a cup of coffee (Gilbert et al., 1976).Caffeine is an antagonist of phosphodiesterases and adenosine receptors(Boswell-Smith et al., 2009; Holtzman et al., 1991). It affects the central nervous system by increasing dopamine, nor adrenaline and glutamate (Ferré et al., 1997). It may incease heartbeat, systolic and diastolic blood pressure and it may reduce cerabral and coronary blood flow (Namdar et al., 1990; Namdar et al., 2009). Mitani et al. have observed that caffeine might suppress lipid accumulation in adipocytes by inhibiting the secretion of inflammatory cytokines (Mitani et al., 2017).

Caffeic acid: Caffeic acid is one of the metabolities of chlogenic acid (Sato et al., 2011). Caffeic acid has anti-inflammatory, anticancerogenic, and enzyme-inhibiting properties (Chung et al., 2004). It has been shown that there is a negative linear relationship between the serum caffeic acid levels and colon cancer risk. Also, it has been observed that caffeic acid might inhibit IL-8 production in colon cells (Shin et al.,2015).

Chlorogenicacid: Chlorogenic acids have quinic acid and trans-cinnamic acids components (Upadhyay and Mohan Rao, 2013). The major source of chlorogenic acid is coffee that is intaken by diet and the amount of chlorogenic acid depends on daily coffee consumption (Mohan Rao et al., 2012). It is uncertain that it prevents or induces DNA damage. Some researchersclaim that it has protective effects against free radical induced DNA oxidation in human colon HT29 and liver HepG2 cancer cell lines. On the other hand, some other researchers observed that the increased concentration of chlorogenic acid triggered DNA damage (Glei et al., 2006).

Kahweol: Kahweol is a coffee-specific diterpene that is found in Arabic coffee beans oil and its concentration in coffeechangesinbetween the ranges 0.1 to 7 mg/mL (Gross et al.,1997; Arab, 2010). Itmay increase serum cholesterol levels on

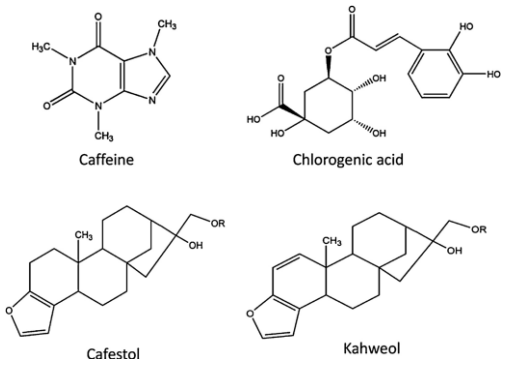

Figure 1. The chemical structures of bioactive components of coffee (Bae et al., 2014)

animals and human (DeRoos et al., 1999). However, it may haveprotective properties against carcinogens (Huber et al.,1997).

Hiypertension: The effects of consumption coffee consumption is transient on hypertensionis transient. It has been observed that the coffee increases acute blood pressure rarely andthe coffee's blood pressure effects are not important on chronic coffee consumers (Mesas et al., 2011).When coffee is consumed regularly, the tolerance develops against its hemodynamic and humoral effects (Robertson et al., 1981). In a study, it has been demonstrated that 6 cups of coffee consumption daily were not associated with increased risk of hypertension (Robertson et al., 2005).

Type 2 Diatebes Mellitus (T2DM): The coffee consumption may reduce the risk of T2DM according to results of cohort studies (Carlsson et al., 2004). There are two hypotheses that for reductionof the risk of diabetesdue to coffee consumptionmay reduce the risk of diabetes. One of them is that the chlorogenic acid component of coffee may inhibit glucose-6-phosphatase system and it may be competitive inhibitor of glucose- 6-phosphate translocase (Arion et al., 1997). Other hypothesis is inhibition of intestinal glucose absorption by chlorogenic acid and other phenolic components of coffee (Welschet al., 1989). In a prospective study, the risk of T2DM was %50% lower in adults consuming at least 7 cup of coffee daily compared to less coffee consumers (<2 cups of coffee) (VanDam et al., 2002).

Insulin Sensitivity: In a recenty study, the researchers have observed that 5 cups of coffee

consumption reduced insulin resistance and it increased tissue adiponectin tissue levels (Wedick et al., 2011).

Hyperlipidemia: Coffee contains cholesterol increasing components such as diterpenes, cafestol and kahweol but the concentrations of these compounds depend on method of how coffee is preparationed (Urgert et al., 1997). In a study, the volunteers were dividedersed into three groups. The first 2 groups consumed 4 to 6 cups of boiled or filtered coffee daily and the other group was placebo. After 9 weeks, there was significant rise in total serum cholesterol levels in volunteers consuming boiled coffee and there was no significant rise serum LDL levels in this group.There was no significant difference in serum lipid levels between other groups (Grobbee et al., 1989). In another study, there was no evidence about the filter coffee increasing serum lipid levelsincrease dur to filter coffee consumption (Lopez-Garcia et al., 2006).

Homocysteine: It has been demonstrated that coffee consumption may increase plazsma total homocysteine levels in man as dose-dependentlytedin researchs (Husemoen et al., 2004). In a study, the homocysteine levels were found higher in participants consuming one liter of unfiltered coffee daily compared to those consuming one liter of filtered coffee (Urgert et al., 2010).

Stroke: Coffee consumption may reduce the risk of stroke. The meta-analysis of seven prospective studies demonstrated that 1 to 3 cups coffee consumption was associated with reduced stroke risk. Other hand, it has been observed that more than 6 cups of coffee consumptioning did not reduce the stroke risk in another study. According to researchers, the coffee is not associated with high stroke risk but habitual moderate coffee may provide protective effects (D'Elia et al., 2012).

Cardiovascular heartdiseases: The studies that have investigated the association between coffee consumption and coronary heart diseases are contradictory. In a meta-analysis with case-control and cohort studies, the coffee consumption was significant associated with cardiovascular heart diseases in short-term but same relationship could not been observed in long-term (Greenberg et al., 2007). The researchers detected that coffee consumption reduced CVD risks and inflammatory diseases in only post menopousal women because of its antioxidant and antiinflamatory properties (Andersen et al., 2006). Butin 21 cohort prospectivestudies, it has been observed that moderate coffee consumption reduced CVD risks in long- term. Also the adults consuming moderate coffee had lower CVD risk compared to those who less consumed (Wu et al., 2009). In another study including patients with STEMI history, there was no cardiacarrhythmia increase in patients due to vagal tonus activation. The researchers agree that the coffee consumption may be confident the patients with STEMI history (Richardson et al., 2009). In conclusion, there are contradictions between studies and the prospective cohort studies have not found significant associations between coffee consumption and CVD risk (Higdonand Frei, 2006).

Heart Failure (HF): There was interesting association between HF risk and coffee consumption. In a recenly study, more or less coffee consumption increased HF risk but 4 cups of coffee consumption daily reducedHF risk. But the patientswere not categorized according to their sex, age, MI or DM history in this study (Mostofsky et al., 2012).

Table 1. The cardiovascular effects of coffee on human health

The acute effects of coffee are transient on blood pressure and it may not increase the risk of hipertension on chronic coffee consumers.
Coffee may reduce the development of T2DM risk.
The effect of coffee on serum lipid levels varies according to types of cooking.
Although there is no strong evidence that coffee reduced high stroke risk, moderate coffee consumption may be protective against stroke.
There are contradictory claims about association between coffee and CVD risk. But coffee may reduce CVD risk in post menopousal womenbecause of reduced inflammation.
Coffee consumption is confident for patients with STEMI history.
The effects of coffee on HF changes as dose dependent
Coffee can reduce all-cause deaths by reducing cardiovascular risk.
Coffeine does not cause serious ventricular and supraventricular cardiac arrhythmias. Also, there is no association between AF and coffee consumption.

Cardiovascular mortality: The coffee was found to be protective on cardiovascular mortality in elderly patients in a study (Greenberg et al., 2007). In another study, the participants with no cancer and no CVD history were included and they were followed during long-term. The results of the study, it has been observed showed that coffee consumption reduced all-cause mortality due to moderately reduced risk of CV disease mortality. Also decaffeinated coffee slightly reduced in all-cause and CV disease mortality (Lopez-Garcia et al., 2008).

Cardiac Arrhythmia: The recent studies demonstrated that coffee consumption did not increase arrhythmia risk. In a study, habitual coffee consumption was inversely associated with hospitalization due to cardiac arrhythmia during long-term follow-up (Klatsky et al., 2011). According to recent studies, high doses coffee consumption did not eaffect heartbeat rate, available rhythmand did not cause serious ventricular and supraventricular arrhythmias (Newcombe et al., 1988). More recently, two prospective studies could find no association between coffee and the risk of atrial fibrillation development atrial fibrillation (Wilhelmsen et al., 2001).

The other effects of coffee on human health

Cancers: Many studies have shown that the coffee consumption was associated with reduced cancer risks but these studies were mostly case-control studies (Nawrot et al., 2003). In the result of the metaanalysis of 17 trials, four or more cups daily coffee consumption causedby 24% reduction of colorekctal cancer risk (Giovannucci et al., 1998). A prospective cohort study indicated that increased coffee consumption was negatively correlatedion with hepatocellular carcinoma risk (Inoue et al., 2005).

Cirrhosis: Coffee consumption was inversely associated with risk of cirrhosis in several case-control studies. A study in Norway, the death from cirrhosis was found by 40% lower in patients consuming two cups of coffee daily compared to those who never consumed (Tverdal et al., 2003).

Parkinson disease: Studies in animal models submitted suggestedthat caffeine consumption decreased the risk of Parkinson's disease by protecting against dopaminergic neurotoxicity (Schwarzschild et al., 2002). In a cohort study, the coffee consumption prevented the death from Parkinson diseases in men but not woman. Perhaps eustrogen replacement theraphy may decrease the benefit of coaffeinein women (Ascherio and Chen, 2003).

Bone fracture: It is claimed that highmuch coffee consumption provoked by 14% more bone fracture because of negative effects on calcium absorption and bone mineral density (Lee et al., 2014; Heaney, 2002; Hallström 2013). However, the researchers explored that 400mgcoffee consumption daily might not damage the calcium absorption and bone mineral density (Wikoff et al., 2017).

Antiinflammatory and antioxidant effects: Several studies have reported that coffee has antinflammatory and antioxidant effects due to bioactive components such as especially caffeine and chlorogenic acid. The researchers agree that coffee may prevent lipid peroxidation, DNA damage and it may reduce the expression of pro-inflammatory cytokines (Sukyoung et al., 2018).

Table 2. The other effects of coffee on human health

It has anti-inflammatory and antioxidant effects.
It decreases the risk of suicide and the symptoms of depression.
It reduces the death from cirrhosis
It is associated with lower colorectal cancer risks.
It has benefict effects on Parkinson disease.
It may have negative effects on bone mineral density and may reduce calcium absorption to bone.

Suicide, anxiety and depression: Each cup of coffee can reduce the risk of suicide by 24% (Kawachi et al., 1996). Also, the coffee consumption may relieve the depreesion symptoms and it is associated with lower risk of anxiety (Tse et al., 2009; Wang et al., 2016).

Adverse effect of coffee and caffeine:

The coffee may cause tachycardia, palpitations, insomnia, restlessness, nervousness, tremor,

headache, abdominal pain, nausea, vomiting, diarrhea and dieresis depending on caffeine component of coffee (Engebretsen et al., 2001). Caffeine may cause withdrawals symptoms including headaches, fatigue, drowsiness, and irritability, difficulty concentrating and depressed mood in consuminglong-termconsumption (Dews et al., 1999). Caffeine may increase the adverse effects of sympathetic agents and acetaminophen. It may inhibit antipsychotic agents' elimination and metabolism (Mendelsohn, 2001).

CONCLUSION

Although coffee is one of the mostconsumed drinks and it has rich bioactive components, the studies on human health are still controversial. Therefore, health professionals should be aware of the effects and side effects of coffee consumption and should be careful. Alsorandomized controlled prospective and high-evidence studies that will clearly demonstrate the effects of coffee consumption on heart and human health are needed.

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