



Mini Review

Coffee and health

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ABSTRACT

Most people start their day with a cup of coffee. Many people would also finish their daily work with coffee. As such, coffee drinking is an important part of modern daily life. It has been told that coffee is a driving force for humans to develop science, because it has an alerting effect on the human brain. However, some people report experiencing irregular heartbeat or headaches and are thus reluctant to drink coffee, which suggests individual variation to coffee intolerance. The aim of this review is to briefly summarize the effects of coffee on human health.

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Coffee has taken an important place in human society for at least 1200 years. Its consumption, which probably originated in northeast Africa, spread out to the Middle East in the 15th century and thence to Europe. After oil, coffee has become the second most valuable commodity around the world. Today, coffee is among the most widely consumed pharmacologically active beverages, and its consumption has become a regular part of daily life worldwide. It is estimated that more than half of Americans drink coffee every day. The average consumption for a person in the European Community is 5.1 kg/year, which is similar to that in the United States.¹

In fact, coffee is a complex mixture of chemicals, and is the main source of caffeine in many populations. However, it also contains thousands of different chemicals, including carbohydrates, lipids, nitrogenous compounds, vitamins, minerals, alkaloids, and phenolic compounds (Fig. 1).²

Although caffeine is a major component of coffee, the content is highly variable—ranging between 30 mg and 175 mg in a cup (150 mL) of home-prepared coffee. Caffeine is the most widely consumed psychoactive drug worldwide and appears to exert most of its biological effects through the antagonism of the adenosine receptor. Adenosine is an endogenous inhibitory neuromodulator that prompts feelings of drowsiness, and thus caffeine induces generally stimulatory effects in the central nervous system. In addition, the physiological effects of caffeine intake include acute elevation of blood pressure, increasing metabolic rate, and diuresis.³ Based on the data reviewed, it can be concluded that moderate caffeine intake (2–3 cups or 300 mg/day) is not associated with adverse effects, such as cardiovascular stimulatory effects and behavioral changes, at least in healthy adults.⁴ However, caffeine is not completely harmless. In fact, caffeine crosses

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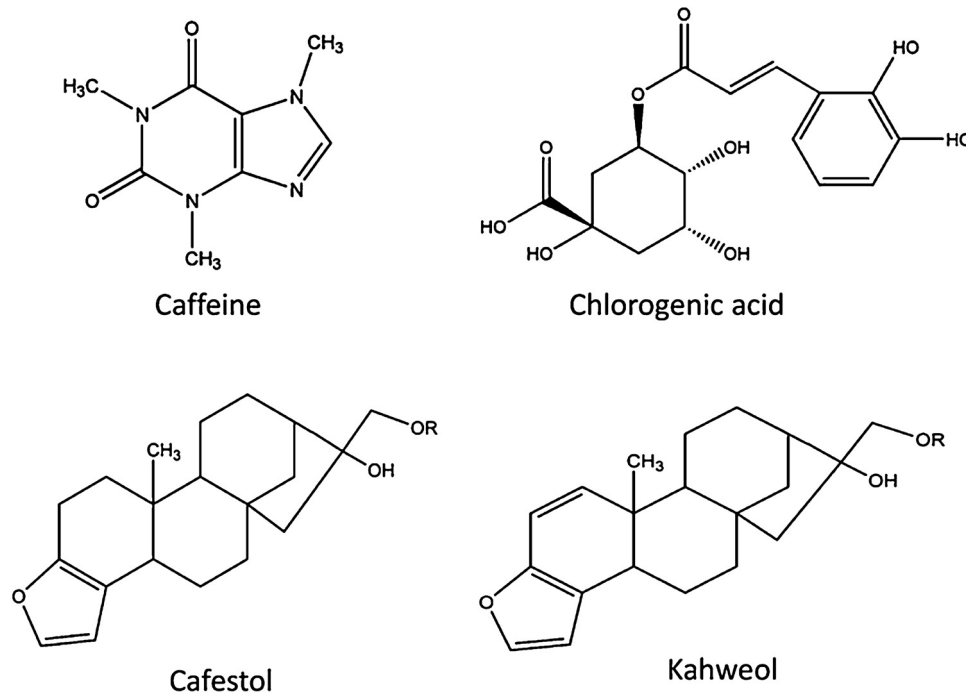


Fig. 1 – Chemical structures of major biologically active compounds in coffee.

the human placenta, rapidly reaching a similar concentration in the fetus and mother. The excessive intake of caffeine has been implicated as a cause of spontaneous abortion or impaired fetal growth.³ Caffeine intake for women who plan to become pregnant and for women during gestation should not exceed 300 mg/day. In a variety of studies for caffeine ingestion, children can be defined as another risk group because altered behavior including nervousness or anxiety is found.³ It is judged that an intake of 2.5 mg/kg body weight/day is an upper limit of caffeine consumption in children (Federal Department of Health, Ottawa, Ontario, Canada).

Is there an antioxidant in coffee? Yes, indeed. Coffee is the number one diet source of antioxidants in many countries including the United States, Italy, Spain, and Norway. Coffee beans contain phenolic antioxidant compounds. The major polyphenol in coffee is chlorogenic acid. Chlorogenic acid is one of the major strong antioxidant compounds in coffee.⁵ The antioxidant activity of coffee depends on the chemical composition. In addition, it was observed that the antioxidant activity of coffee varies according to the degree of roasting. Maximum antioxidant activity was measured for the medium-roasted coffee.⁶

Coffee consumption has been associated with higher concentrations of serum total cholesterol and low density lipoprotein cholesterol. Cafestol and kahweol are two diterpenes found in coffee oil. Diterpenes are the main cholesterol-raising compounds in coffee, but they are mostly removed by paper filters. Therefore, unfiltered coffee is a significant source of diterpenes, whereas the consumption of filtered coffee results in very little increase in serum cholesterol.⁷

The relationship of coffee with health has been featured in more than 8000 professional medical studies during the past

40 years. However, in many cases, conflicting findings and concerns have arisen, making it difficult for health professionals and the public to interpret the data. Coffee consumption tends to attract tobacco smoking, but many studies did not account for this potential confounding the data analysis.⁸ Some measurement errors seem to be inevitable in the assessment of coffee consumption, because people consume a wide variety of coffee from day to day. Coffee intake is determined by the size of the coffee cup and the strength of the brew as well as frequency of consumption. Despite 20 years of reassuring research, many people still avoid caffeinated coffee because they worry about the biological effects of caffeine. What is the conclusion of so much attention? We have thought that coffee is good for your health when consumed in moderation. Harvard Women's Health Watch (2004) reported that current research reveals that in moderation coffee is a safe beverage that may even offer some health benefits.⁹ However, it is also emphasized that difficulties and challenges in designing a solid experiment or clinical trials to elucidate the effects of coffee on human health are present.

Many studies show that coffee consumption may help prevent several chronic diseases. In particular, long-term coffee consumption is associated with significant dose-dependent reductions in the risk of developing type 2 diabetes.⁴ Furthermore, coffee intake reduces the risk of liver damage in people at high risk for liver disease including hepatic injury, cirrhosis, and hepatocellular carcinoma.¹⁰ Its consumption is also inversely associated with the risk of Parkinson's disease in men and women who have never used postmenopausal estrogen.¹¹ The risk of Alzheimer's disease is lower in those who regularly consume caffeine-containing coffee than in those who do not drink it.¹² Coffee has also been shown to improve endurance performance in long-duration physical

activities. It is very interesting that the relative risk of suicide was decreased by 13% for every cup of coffee consumed daily.¹³ In general, coffee consumption has been inversely associated with the risk of cancer at various sites including liver and colorectum, but there is no clear explanation of how coffee protects against cancer.¹⁴

It should be considered that coffee does have modest cardiovascular effects such as tachycardia, high blood pressure, and occasional arrhythmia.¹ The acute effects of coffee on the cardiovascular system might arise in the time immediate to coffee intake or in more susceptible individuals. Recent analyses have concluded that a weak inverse association may exist between coffee consumption and the risk of stroke, but further research is needed to clarify this.¹⁴ Although there is no definite clinical relationship between coffee intake and the risk of cardiac arrhythmia, many doctors would not recommend coffee for the patients. Any contribution of coffee ingestion to the development of hypertension is likely to be small, but it is considerable particularly in infrequent coffee drinkers.⁴ Caffeine leads to a slight decrease in the efficiency of calcium absorption in gastrointestinal tract. Thus, an adequate intake of calcium and vitamin D and a limitation of coffee intake to 2–3 cups/day may help reduce the risk of osteoporosis and its related fracture particularly in elderly adults.³

Coffee consumption is used for social activity, leisure, improvement of work performance, and well-being. Coffee is not only a medicinal alternative but also a beverage containing numerous potential health benefits. The results from many types of research suggest the positive effects of coffee consumption on various aspects of health, as mentioned above briefly. Despite the general good outcomes, it should be emphasized that individual sensitivity to coffee and the biological effects of coffee among humans may vary because of personal single nucleotide polymorphic variants, as shown in an investigation on genetic polymorphisms in apolipoprotein E (APOE).¹⁵ And some negative effects of coffee tend to emerge in excessive drinking, so it is the best to avoid heavy coffee intake. This minireview covers just a few of the health benefits and adverse effects associated with drinking coffee. Further studies on the functionally significant polymorphisms are needed for a better understanding of the effects of coffee on personal health.

Conflicts of interest

All contributing authors declare no conflicts of interest.

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