Cardioprotective effects of coffee

Anna Karaś, Kinga Kawałko, Kamil Pondel, Krzysztof Bielewicz

SUMMARY

Coffee is one of the most consumed beverages among adults. Popular for its stimulant properties, it is also appreciated for its taste and is an essential part of many people’s daily lives. Coffee, in addition to caffeine, contains macroelements such as sodium, potassium and magnesium, which ensure the proper functioning of the body, as well as polyphenols which are characterised by their anti-inflammatory properties. [1,2] Atrial fibrillation is the most common arrhythmia and caffeine is often considered a potential risk factor. [3] The purpose of this article is to evaluate current scientific reports on the relationship between coffee consumption and atrial fibrillation.

Keywords: coffee, caffeine, atrial fibrillation, chlorogenic acid, cardioprotection

INTRODUCTION AND PURPOSE

Coffee is an indispensable part of the day for many people. As a result of its stimulating properties and taste, it has gained popularity all over the world, and its consumption is systematically increasing. [1] It is served in different ways, with various additives, such as milk, sweeteners, ice cream or flavored syrups, but it retains its greatest health benefits without them. [4] Coffee, in addition to caffeine, contains macroelements such as sodium, potassium, magnesium and phosphorus and may be an overlooked source of these elements in the diet. At the same time, it is important to remember that caffeine has a diuretic effect and can lead to water and electrolyte loss. [1] Coffee contains polyphenols known for their antioxidant activity. [2]
However, most people do not think about its pro- or anti-health qualities when reaching for a cup of coffee, focusing instead on its properties such as reducing fatigue or improving cognitive function. [5]

The effects of caffeine are determined by many factors and are individually variable, depending on the dose, the foods consumed with coffee, the genetic polymorphism of enzymes involved in caffeine metabolism or personal tolerance. [6] Caffeine affects almost the entire body, modifying activity of the central nervous system, digestive system, circulatory system, urinary system and musculoskeletal system. [7] Effects on the cardiovascular system may include changes in heart rate, heart rhythm and blood pressure.

Atrial fibrillation (AF) is the most common arrhythmia worldwide, with serious and potentially fatal complications including heart failure, stroke or myocardial infarction. [8] The following paper will provide a summary of current knowledge regarding the effects of coffee drinking on AF.

STATE OF KNOWLEDGE

Atrial fibrillation is characterized by uncoordinated electrical discharges within the electrically conductive cardiomyocytes. This leads to rapid and ineffective atrial contractions, causing the sinoatrial rhythm to be disturbed and the ventricles to contract irregularly. [8] The atrial rhythm rate can be as high as 700 per minute, which does not necessarily reflect the heart rate, which can be normal, accelerated or slowed. [9] AF can be asymptomatic or cause such symptoms as palpitations, dyspnea, chest pain, paroxysmal sweats, syncope, vertigo or anxiety [9, 10], which are adversely affected, inter alia, by increased heart rate [11].

Atrial fibrillation can be divided into:

- recognized for the first time,
- paroxysmal, usually self-limiting, lasting up to 7 days,
- persistent, occurring continuously for more than 7 days,
- persistent long-standing, lasting over 12 months, with heart rhythm control as the chosen management strategy,
- permanent, it is AF where no attempts are made to restore the sinus rhythm with the mutual consent of the patient and the physician. [12]

Risk factors for atrial fibrillation can be divided into non-modifiable, such as genetic factors [13,14] or age [15,16], and modifiable. The second group is quite extensive and can include conditions such as diabetes mellitus [17,18], hypertension [19,20], obstructive sleep apnea [21] or obesity [22,23]. Sedentary lifestyles and low physical activity may also contribute to AF [24], although some studies report that excessive exercise might provoke occurrence of AF in men [25]. Cigarette smoking, a known risk factor for many diseases, can also lead to AF. [26] It is important to note that passive exposure to cigarette smoke may also be associated with the onset of AF. [27]

A cup of coffee contains 30 to 130 mg of caffeine. [2] The half-life of caffeine in healthy people is approximately 5h. It is rapidly absorbed through the gastrointestinal tract and metabolized in the liver. The lethal dose of caffeine is about 150-200 mg/kg body weight. [5] Caffeine's influence on the cardiovascular system is based, among other things, on an increase in the catecholamines present in the blood. Its antagonistic effect on adenosine receptors indirectly leads to increased catecholamine output. Further, its inhibitory effect on phosphodiesterase may have a cardiostimulatory effect. [5, 28]

The above properties of caffeine may raise concerns about its proarrhythmic potential. However, conducted studies do not include caffeine among risk factors for atrial fibrillation. Moreover, its consumption may be expected to reduce the incidence of this arrhythmia. It has been suggested that more than two cups of coffee per day, may even reduce the risk of AF. [6,28,29] Some data suggest that the higher the consumption of coffee, exceeding 4 cups of coffee per day, the lower the risk of AF. [30]
Caffeine is a competitive antagonist of adenosine receptors, including the A2A receptor, which can be found, inter alia, in the heart. Increased expression of this receptor is observed in people with arrhythmias, such as atrial fibrillation. Caffeine can potentially inhibit the development of this condition by modifying the action of adenosine receptors. However, it should be remembered that caffeine's action on adenosine receptors causes an increase in serum adenosine levels. Increased levels of this nucleoside are also observed in AF patients, although it is postulated that this is due to increased expression of A2A receptors. Nevertheless, the effects of caffeine in coffee on receptors present in the heart should be further investigated. [31]

People who do not drink coffee regularly and consume it in small amounts (less than half a cup per day) have a slightly increased risk of atrial fibrillation. It is suspected that regular drinking of larger amounts of coffee, and the resulting habituation, may inhibit the effects of adenosine on the heart in the long term. Adenosine shortens the atrial refractory period, and thus caffeine's inhibition of its action may protect the heart from atrial fibrillation. [32]

Available studies indicate that the antiarrhythmic effect of coffee is not solely due to the action of caffeine, but is more attributable to other substances in it. [30] Coffee is a very rich source of polyphenols, including chlorogenic acid, which is a powerful antioxidant agent. Its content in a cup of coffee ranges from 70 to 350 mg, depending on the type of coffee and brewing method. Chlorogenic acid has an anti-inflammatory effect, reducing the formation of, inter alia, pro-inflammatory cytokines. [2] The above action of this polyphenol may counteract inflammatory processes that lead to atrial remodeling and associated arrhythmias, such as atrial fibrillation. [28,33]

The antioxidant and anti-inflammatory properties of polyphenols may also affect other risk factors for atrial fibrillation, such as diabetes mellitus type 2. Chlorogenic acid, contained in coffee, has a modifying effect on carbohydrate metabolism. Available literature indicates that it increases tissue insulin sensitivity, lowers fasting serum glucose levels, as well as decreases intestinal glucose absorption [2,34] and increases glucose uptake in muscle [35]. Regular coffee consumption is associated with a reduced risk of type 2 diabetes, a risk factor for atrial fibrillation. [2,34,36]

The effect of coffee consumption on blood pressure values remains a controversial topic. Several studies indicate that the increase in blood pressure values after coffee consumption is present only for a short period of time and regular coffee drinkers show tolerance to this effect, hence the risk of AF is not increased. [32,6] However, it should be remembered that caffeine contained in coffee has vasoconstrictive effects and some caution should be applied in people with known hypertension. [6]

Accelerated heart rate can exacerbate symptoms of atrial fibrillation. Coffee, by affecting the output of catecholamines, could potentially increase heart rate, although studies on this topic are inconclusive. [6] Moreover, regular coffee consumption may have a positive effect on resting heart rate by reducing it. [37]

For some time now, coffee has been appreciated for its neuroprotective properties. Ischemic stroke is one of the most serious complications of atrial fibrillation. According to several available studies, coffee protects against it and also reduces the deficits generated by ischemic brain damage. [38,39] Furthermore, moderate coffee consumption is not associated with an increased risk of AF in people with a positive medical history of arrhythmia. [40]

CONCLUSIONS

As well as its stimulating and cognitive-enhancing properties, coffee can also be part of a healthy diet. Drinking 3–4 cups of coffee a day on a regular basis does not increase the risk of atrial fibrillation, in fact, a number of available data even indicate a reduced risk of this arrhythmia in people who drink 3 or more cups of coffee a day. Consumed without additives such as sugar or milk, it retains its unique properties. As a result of its antioxidant and anti-inflammatory values, it can prevent atrial remodeling and thus the occurrence of AF. Due to its positive effect on carbohydrate metabolism, it prevents the risk factor for AF, namely diabetes mellitus type 2. Coffee also exhibits neuroprotective effects. One must be aware that coffee metabolism and the organism's response to its effects is individually variable and influenced by genetic polymorphisms.
As a rich source of polyphenols, coffee appears to be a product with beneficial qualities and its effects ought to be further investigated.

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