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An Analysis of Impact of Coffee on Health

Piyush Mittal, Professor,
Department of Pharmacy, Teerthanker Mahaveer University Moradabad, Uttar Pradesh, India
Email Id- mittalpiyush23@gmail.com

ABSTRACT: ***Due to its stimulating effects on the central nervous system, as well as its flavour and fragrance, coffee is one of the most popular and frequently consumed drinks in the world. Caffeine and chlorogenic acids are the most prevalent components in coffee, which is a complex combination of around 800 volatile chemicals. Due of its better-known pharmacology, coffee has gradually shifted to a less unfavourable health stance in recent years. Caffeine seems to exert the majority of its effects via antagonizing adenosine receptors, as in a cup of coffee. Coffee intake may assist to avoid many chronic illnesses, including type 2 diabetes mellitus and liver disease, according to new epidemiological and experimental study. Coffee intake has not been linked to an elevated risk of cardiovascular disease in the majority of prospective cohort studies. There is also evidence that decaffeinated coffee may have comparable health benefits to normal coffee in certain ways, suggesting that additional components contribute to the health-protective effects in addition to caffeine. There is minimal evidence of health hazards and some evidence of health benefits for people who drink moderate quantities of coffee (3–4 cups per day, giving 300–400 mg of caffeine). This evaluation gives you the most up-to-date information on the effects of coffee on your health. The cardiovascular system, liver problems, diabetes, and gastrointestinal issues are among the topics covered.***

KEYWORDS: ***Caffeine, Cardiovascular, Coffee, Health, Pharmacology.***

1. INTRODUCTION

Coffee has a long history, with many stories concerning its usage dating back to the 10th century. Ethiopia is believed to be the coffee's natural (undomesticated) home. The first documented evidence of coffee consumption or knowledge of the coffee tree dates from Yemen's Sufi monasteries in the 15th century. It had spread across the Middle East, South India, Persia, Turkey, and Northern Africa by the 16th century. The Balkans, Italy, and the rest of Europe followed, followed by Indonesia and finally America. Despite the fact that coffee was only brought to Europe a few hundred years ago, it has become an important part of our national traditions. Coffee is a brewed beverage made from the roasted seeds of a plant belonging to the genus Coffee. The coffee beans are housed in berries that are processed and dried once they have matured. Coffea Arabica (coffee Arabica) and Coffea canephora are the two major species (coffee Rustica). They have a long history of manufacturing and play a significant role in worldwide markets and research[1].

Coffee use is likely to have a significant impact on public health. As a result, it's no surprise that coffee piques the attention of scientists and doctors. Nonetheless, the impact of coffee consumption on chronic diseases has been a source of debate for the past two decades, with some contradictory results due to the retrospective nature of most studies, though coffee has gradually moved to a less negative position as a result of its better-known pharmacology. Coffee intake seems to be linked to a lower risk of many chronic and degenerative illnesses, according to new epidemiological and experimental studies. This article examines coffee's most important protective effects on the cardiovascular system, liver illness, diabetes, and gastrointestinal problems, including IBD. Clinical and experimental research are addressed, with the function of caffeine and polyphenols given if possible[2].

1.1 Bioactive Components in Coffee:

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 10, October 2022

Coffee is made up of a complex combination of chemicals. Coffee varietal, roasting, and processing all influence the chemical profile. Caffeine is the most studied component of coffee and is probably the most well-known chemical. Chemical interactions between amino acids and carbohydrates, known as Maillard reactions, occur when green coffee beans are roasted at high temperatures, resulting in a variety of distinct components. Coffee also contains a lot of polyphenols, such as chlorogenic acids. 5-caffeoylquinic acid is the most abundant chlorogenic acid in coffee, although other chlorogenic acids such as caffeoylquinic, feruloylquinic, and dicaffeoylquinic acids are also found in considerable amounts. The potential bioefficacy of phenolic metabolites of chlorogenic acids has been investigated, however the findings are still inconclusive. Due to the complicated metabolic pathways in humans, only a few research have looked into the bioavailability of coffee phenolic and chlorogenic acids. Chlorogenic acids may be converted to phenolic acids, which can then be converted to colonic metabolites (dihydrocaffeic and dihydroferulic acids). Many distinct metabolites (aglycone, sulfate, glucuronide, and methyl) could be detected from a single cup of coffee thanks to extensive conjugation in the gut and liver. Coffee also contains lactones, diterpenes such as cafestol and kahweol, niacin, and the vitamin B3 precursor trigonellin. In cell and mouse models, the antioxidant activity of cafestol and kahweol present in coffee oil was shown by stimulating the upregulation of important antioxidant enzymes. The two diterpenes, on the other hand, are the primary cholesterol-raising chemicals in coffee. They are somewhat retained by paper filters, but they are maintained when coffee is made straight from ground beans by boiling them. Coffee is also high in B vitamins, magnesium, and potassium[3].

1.2 Pharmacokinetics and Mode of Action of Caffeine:

Caffeine is the world's most commonly used behaviorally active drug. It may be found in a variety of foods, including tea, coffee, cocoa beverages, chocolate bars, and soft and energy drinks. In the 1820s, German scientist Friedrich Ferdinand Runge refined caffeine from cocoa beans into its purest form, a white powder. Caffeine is found in over sixty species, which is a large number. It is thought that caffeine was formerly a minor nutrient that was not necessary to the plant but was very helpful as a pesticide. Caffeine is harmful to a variety of insects and animals, particularly herbivores. Caffeine allows the plant to protect itself and increase its chances of survival. Caffeine may be seen as a "co-evolutionary protective agent" in this perspective. The quantity of this natural alkaloid in coffee is determined by the manner of coffee preparation, and a regular cup of coffee may have anywhere from 65 to 120 mg of caffeine, while Arabica coffee typically has less caffeine than Robusta coffee. Caffeine content in soft drinks ranges from 30 to 60 mg per serving. Energy drinks, on the other hand, may contain up to 80 mg of caffeine per serving. The caffeine in these beverages comes from the ingredients themselves or from an addition obtained through decaffeination or chemical synthesis[4].

Within 45 minutes of oral intake, caffeine is fully absorbed by the stomach and small intestine. Caffeine's hydrophobic characteristics enable it to pass through all biological membranes, and in humans, the peak plasma concentration is achieved 15–20 minutes after oral intake. The cytochrome P450 oxidase enzyme system, particularly the CYP1A2 enzyme, metabolizes caffeine in the liver into three main metabolites: paraxanthine (84 percent), theobromine (12 percent), and theophylline (4 percent). The NAT2 enzyme, which catalyzes the transformation of a wide variety of xenobiotics, is also implicated in caffeine clearance. This enzyme has previously been investigated in connection to Parkinson's disease risk and gene-environment interactions, with conflicting findings. Caffeine's half-life varies greatly based on a variety of variables, including age, liver function, pregnancy, certain concomitant medicines, and the amount of enzymes in the liver required for caffeine metabolism. Caffeine

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 10, October 2022

has a half-life of around 3–4 hours in healthy people. The half-life period is raised to 5–10 h in women who use oral contraceptives, and 9–11 h in pregnant women. It may be longer in babies and early children than in adults[5].

Caffeine works primarily as an antagonist of adenosine receptors at levels appropriate for human ingestion. Adenosine receptors A1, A2A, A2B, and A3 have all been cloned. A1 and A3 receptors bind to Gi proteins and inhibit adenylate cyclase, while A2A and A2B bind to Gs and increase cyclic AMP synthesis (cAMP). These receptors are extensively expressed in the human body and have been linked to a variety of physiological and pathological biological activities. These include inflammatory illnesses, ischemia-reperfusion, and neurodegenerative disorders, as well as heart rhythm and circulation, lipolysis, renal blood flow, immunological function, sleep regulation, and angiogenesis. Caffeine is physically identical to adenosine and may effectively inhibit adenosine actions on A2A and A1 receptor subtypes even at low concentrations, such as those obtained after a single cup of coffee. Phosphodiestarases must be inhibited at twenty times greater doses to prevent cyclic nucleotide breakdown. To inhibit GABAA receptors 40 times more effectively and mobilize intracellular calcium reserves through ryanodine receptor activation, 100 times more concentrations are required. Caffeine concentrations this high are unlikely to be achieved in humans via regular coffee consumption. Soft drinks and teas are the main sources of caffeine for children and young adults, whereas coffee is the primary source for people aged 25 and above. Intriguingly, tea is more often consumed in Asia than coffee[6].

1.3 Effects of Coffee on the cardiovascular System:

The link between coffee intake and the risk of cardiovascular disease is hotly debated. Given the high frequency of coffee drinking and CVD in Western nations, the connection between coffee intake and the risk of coronary heart disease was first investigated in the 1960s. Coffee intake with other CVD events such as stroke, heart failure, and overall CVD mortality have been investigated and summarized in meta-analyses more often since 2000. These meta-analyses found no evidence of a link between coffee intake and an increased risk of CVD, although the form of the link is still unknown. Surprisingly, a meta-analysis published in 2014 found that moderate coffee intake was linked to a reduced CVD risk, whereas excessive coffee consumption was not linked to either a higher or lower CVD risk. A second meta-analysis found that excessive coffee intake was not linked to an increased risk of CVD mortality. In contrast, a cohort study conducted by a researcher showed that drinking 4 cups of coffee per day was linked to an increased risk of death, although the link was only significant for those under the age of 55. Other metaanalyses and the vast majority of research in the literature contradict the findings of this study. A limited sample size, a lack of current dietary assessments, and subgroup analyses may all be factors in the difference. Furthermore, none of the research included in this review looked at coffee brewing techniques[7].

Pharmacological investigations have shown that A1 receptor activation reduces heart rate and atrial contractility, as well as the stimulatory effects of catecholamines on the heart, and that A2A receptors are implicated in aortic and coronary artery vasodilation. Caffeine's ability to inhibit these receptors may contribute to coffee's CVD-protective properties. Aside from caffeine, findings from experiments using unfiltered and paper-filtered coffee, as well as caffeinated and decaffeinated coffee, indicated that additional components were involved. For example, chlorogenic acids and their metabolites lower blood pressure through improving endothelial function and nitric oxide bioavailability in the arterial vasculature. The current data, although limited, supports the conclusion that moderate coffee consumption is not

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 10, October 2022

associated with an increased risk of cardiovascular disorders, including stroke. Coffee's cardiovascular effects may be influenced by not just caffeine, but also other components[8].

1.4 Coffee and Type 2 Diabetes:

Coffee has lately gained scientific interest as a contemporary epidemiologic topic, with in vivo research revealing its health advantages against metabolic diseases, particularly type 2 diabetes. In most, but not all, investigations, an inverse connection has been found. As a result, in 2014, a researcher released an updated systematic review and a dose-response meta-analysis of all available data on the connection of both caffeinated and decaffeinated coffee intake with the incidence of type 2 diabetes. Based on 1 109 272 research participants and 45 335 instances of type 2 diabetes, the systematic review and meta-analysis found a strong negative relationship between coffee intake and diabetes risk. 6 cups of coffee per day was linked to a 33% reduced risk of type 2 diabetes when compared to no coffee intake. Both men and women showed the same pattern. In contrast, a multiethnic cohort research found that coffee consumption had a greater protective impact for women (34 percent reduced diabetes risk) than for males (14 percent lower diabetes risk). The difference may be attributable to the use of self-reported dietary questionnaires to measure coffee consumption[9].

1.5 Coffee and Liver Diseases:

There is mounting evidence that coffee intake may help prevent the development and progression of liver disease caused by a variety of factors. Wadhawan and Anand examined the clinical data supporting the benefits of coffee intake in hepatitis B and C, as well as non-alcoholic fatty liver disease and alcoholic liver disease, in 2016, while Liu et al. assessed the evidence for hepatic fibrosis and cirrhosis in 2015. The two meta-analyses clearly showed that coffee consumption of more than 2 cups per day is linked with a reduced incidence of fibrosis and cirrhosis, lower hepatocellular and carcinoma rates, and lower death in patients with pre-existing liver disease[10].

Several investigations utilizing conventional mouse models of experimental liver fibrosis have shown the protective benefits of caffeine against liver fibrosis. In nearly every research, coffee/caffeine consumption prevented toxin-induced liver fibrosis/cirrhosis. Caffeine has been found to decrease hepatic stellate cell activation by inhibiting A2A receptors in experimental fibrosis models, and increasing data suggests that caffeine may also benefit angiogenesis and hepatic hemodynamics. Gressner et al. have previously shown that caffeine suppresses TGF-induced CTGF expression in hepatocytes. Coffee and caffeine treatment reduces TGF- levels in rats with chemically induced liver fibrosis. Vitaglione et al., on the other hand, found that drinking decaffeinated espresso coffee reduced not just hepatic steatosis but also inflammation and fibrosis in rats. As a result, it's possible that caffeine in coffee isn't required for hepatoprotection, and that other coffee components play a role. Hepatoprotective properties of chlorogenic acid The acid pretreatment seems to be efficient in reducing TCBQ-induced oxidative stress, therefore having a hepatoprotective character, according to a recent research on TCBQ-induced liver injury in mice. In addition, chlorogenic acid decreased liver fibrosis and collagen I and III expression. VEGF, TGF-, and -smooth muscle actin concentrations were all lower in these rats. In rats and hepatocyte cultures, the diterpenes cafestol and kahweol may protect against aflatoxin B1-induced liver damage. Cafestol and kahweol may also stimulate the production of glutathione, a substance that aids in detoxification and prevents liver damage. An increasing corpus of research has repeatedly shown an inverse connection between coffee intake and liver disease. However, there is insufficient evidence to draw strong conclusions regarding the relative significance of caffeine or other coffee components in the development and progression of liver disease.

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 10, October 2022

1.6 Coffee and inflammatory Bowel Disease:

Too far, there is no link between coffee intake and the risk of dyspepsia, gastroesophageal reflux disease, peptic ulcers, gastritis, or stomach cancer, according to studies. Coffee is consumed by individuals with IBD as well, however it is unclear if coffee intake is safe for those who have a chronic digestive illness. CD and UC are the two main types of IBD. Coffee was shown to have a preventive effect against the development of UC in a research by Ng et al. Another research found that increased coffee intake is inversely linked to the severity of inflammatory disorders in 41 836 postmenopausal women during a 15-year period. The anti-inflammatory and antidiarrheal effects of the herbal combination of myrrh, dry extract of chamomile flowers, and coffee charcoal are well recognized. 96 individuals with inactive UC were assigned to receive either the herbal concoction or mesalazine during a 12-month period in a randomized, double-blind, double-dummy trial. The relapse rate did not vary significantly between the two groups. There were no significant changes in relapse-free time, endoscopy, or fecal biomarkers.

However, it is thought that the effects of coffee are related to various particular components rather than being just attributable to caffeine. In a well-established mouse model of experimental colitis, chlorogenic acid showed substantial anti-inflammatory action, as shown by a decrease in macroscopic damage score, myeloperoxidase activity, and suppression of the NF-B dependent pathway. Apart from these, a recent research found that chlorogenic acid inhibited cyclooxygenase-2, inducible nitric oxide synthase (iNOS) with no cytotoxic impact, attenuated IL-1 and IL-6 along with TNF- in a dose-dependent way, and inhibited NF-B in a DSS-induced colitis.

2. DISCUSSION

Coffee is a popular beverage all around the globe. It contains a diverse set of elements that have the ability to affect one's health. Coffee contains caffeine, chlorogenic acids, and diterpenes, which are all essential components. Tolerance is often used to control the biological effects of coffee. Coffee has a major effect on the cardiovascular system, as well as glucose and lipid metabolism. Contrary to popular perception, coffee consumption seems to have no effect on different types of arterial cardiovascular disease, arrhythmia, or heart failure. Coffee consumption is linked to a lower risk of diabetes and liver disease. Among the neurological diseases, Parkinson's disease seems to be protected, but its role as an osteoporosis risk factor is debatable. Its impact on cancer risk varies depending on the tissue, but it seems to favor risk reduction. Coffee intake seems to lower death rates. This paper discusses Impact of coffee on health.

3. CONCLUSION

There are still a lot of misunderstandings regarding coffee and health, which may make it difficult to know if coffee can be part of a healthy, balanced diet. As a consequence, the possible impact of coffee on the risk of a variety of illnesses has been extensively researched in recent years, with mixed findings. The recognition that coffee and caffeine are not interchangeable has piqued curiosity in whether additional components of coffee contribute to the protective effect in the human body, and if so, in what way. Polyphenols have been the subject of the bulk of study in this instance. Nonetheless, there is insufficient data to respond to this issue. It's essential to keep in mind that everyone's reaction to coffee is different. Some individuals are more susceptible than others to the consequences. Some of this variation is due to tolerance, but there are signs that it may also have a genetic basis. Another intriguing finding is that men and females have different caffeine reactions, which may be mediated by variations in circulating steroid hormones. Moderate coffee intake of up to 4 cups per day

(about 400 mg caffeine) may be enjoyed by the majority of individuals as part of a healthy, balanced diet and active lifestyle. Lower amounts are suggested for pregnant women, who should restrict their caffeine consumption to 200 mg per day from all sources, and for youngsters, whose intake should be decreased due to their lower body weight. Finally, well-designed, randomized, controlled studies are needed to further investigate the impact of various dosages of coffee or coffee bioactive components on healthy people as well as sick groups in order to clarify key issues that have been debated in the literature.

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