Coffee Intake and Cancer Risk: Exploring the Relationship

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Coffee is grown as a tree in tropical and subtropical regions of Africa, Southeast Asia, and South America. Coffee components are changeable when it is grown as geographical differences. The coffee quality is arranged by various factors which are in the pre-harvesting and post-harvesting periods. In the pre-harvesting period, approximately 40% of coffee's physical and chemical properties are defined, so 60% of factors that affect coffee quality exist in the post-harvesting period. The pre-harvesting period is dependent. The pre-harvesting quality of coffee depends on the soil quality, geography, and sun availability, shaped by environmental factors, etc.[1,2]

The three types of post-harvesting treatments which are wetting, drying, semi-drying, and digestive bioprocessing show differences in coffee components percentages. The digestive bioprocessing methods are applied on a small scale to produce the world's most expensive coffee such as kopi luwak and black ivory coffee.[1]

To study the positive or negative impact of coffee, it is needed to know about components of coffee.[3]

The examined contents and percentages are adjusted to coffee cherry types. So, the roasting

ABSTRACT

Coffee is the most widely drank beverage in the planet. It is also traditional and has the ability to modify its composition degree depending on where and how it is prepared as a country. Traditionally, each country employs a particular way of preparing coffee. Coffee is the most consumed beverage, and it has been investigated to compound due to the therapeutic effect of coffee as a chemoprevention on many diseases such as stomach cancer, breast cancer, liver diseases, and many disorders such as neuron degeneration. On the other hand, numerous research have found that coffee has a deleterious impact. The composition of coffee, the ratio of bioactive chemicals depending on preparation conditions, the pre-harvesting and post-harvesting period, and the roasting degree are all taken into account in this review. These distinctions in coffee components are investigated on organs and cells that would be either preventative as antioxidant characteristics of coffee or disease-causing agents.

Keywords: Bioactive compounds, cancer incidence, cancer prevention, coffee.

degree of coffee also affects its percentages. The roasting temperatures and times are set according to want. The roasting degrees vary as light, medium, and dark are adjusted respectively, at 230 °C for 12 minutes, at 240 °C for 14 minutes, and at 250 °C for 17 minutes with 100 grams of unroasted coffee. The coffee berry contains volatile chemicals, which are responsible for the coffee's fragrance and flavor. These chemicals are found in small amounts in the early stages of the coffee cherry, but as the coffee matures, they become more abundant. Green coffee beans have greater antioxidant activity, total phenolic content, total flavonoid content, and tannin content than roasted coffee beans in all treatments. In addition, depending on the degree of roasting and the volume drank, one cup of coffee contains between 20 to 675 mg of chlorogenic acid which is present as the most abundant bioactive molecule in coffee.[4-6]

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There are examined caffeine quantities on known coffee types such as Starbucks coffee, short (250 mg), coffee brewed (135 mg), roasted and ground, drip (112 mg), Maxwell House, regular (110 mg), roasted and ground, percolated (74mg), Starbucks espresso (70 mg), instant (66 mg), and Maxwell House, mocha cappuccino (60 mg).[7] In addition, milk is the most used material for coffee. The bioavailability of total phenolic bioaccessibility of coffee with whole milk and skimmed milk is not affected by adjusting pH or using high-pressure homogenization processing. Thermal treatment, on the other hand, may reduce the bioaccessibility of phenolics in coffee, whether with or without milk. So, whole milk has a higher bioaccessibility of total phenolic components than skimmed milk because of the milk matrix differences.[8]

The coffee cup's composition is influenced by a number of factors, including coffee particle size, extraction time, filter type, and newly trending cold water preparation. According to reports about cold brew coffee, there are significant differences in components in one cup of coffee. Melanoidins do not exist in cold-brew coffee. The health implications of melanoidins in coffee brew are of significant interest since they are one of the primary sources of melanoidins in the human diet.[9,10]

Coffee melanoidins have been linked to a variety of biological activities, including antioxidant, antibacterial, anti-inflammatory, anti-hypertensive, and antiglycation properties. To dissolve, it must be at the proper temperature.Due regard being had to just roast treatment, light-degree roasted coffee has the most abundant phenolic compounds such as chlorogenic acid as an antioxidant, then the medium-degree roasted coffee has more phenolic compounds than dark-degree roasted coffee.[4,11,12]

According to previous reports about coffee effectiveness, hundreds of bioactive compounds such as caffeine, flavonoids, lignans, caffeic acids, etc. are found in roasted coffee. These compounds were studied for such diseases and showed positive impacts like deoxyribonucleic acid repair, and decreasing general inflammation.[3,11]

The preparation methods of coffee to drink affect the quantity of molecules that are present in coffee. As an example, the concentration of diterpene alcohol found in cafestol, and kahweol, which are supposed to be the primary cholesterol-increasing components in coffee, is found to be higher in boiling varieties like Turkish coffee or Scandinavian coffee than in coffee that is poured into hot water via "sock" like traditional coffee preparation method with using specific filter paper in Singapore. It keeps the excess amount of diterpene alcohol on the filter.[5,7,13,14]

ON HEALTH EFFECT

There are two types of hypotheses concerning coffee's effects on the human body: either that it is good for many organs and systems, or that it causes disease in such systems, such as cancer. Both hypotheses are also backed up by evidence from the literature. Many alternatives to coffee are explored in this scenario, including the roasting degree of coffee and the volume consumed in daily life. As a result, the final coffee composition for consumption has certain impacts on the human body according to known ingredients. When coffee is ingested, transplaceable coffee chemicals go through the bloodstream to all tissues and cell plasma. Coffee digestion begins in the stomach, followed by the fermentation process in the intestine. Unique metabolites are produced during the digestive process in the colonic stage and liver metabolites. Caffeic, ferulic, and isoferulic parts are metabolized from chlorogenic acids (CGAs), and then dihydrocaffeic and dihydroferulic acids occur as colonic metabolites. In a cup of coffee, many different metabolites such as aglycone, sulfate, glucuronide, and methyl are determined.[12,15,16]

In Digestive Tract

As mentioned above, coffee digestion starts in the stomach and caffeine is fully absorbed via the stomach and small intestine for just 45 minutes. Along with drinking, the high bioaccessibility of coffee with the hydrophobicity of caffeine shows significant peak concentration in the plasma for 15-20 minutes.[15]

Coffee drinking alone has no effect on the digestive system of the stomach. Excess coffee consumption with nutrition style, alcohol consumption, smoking, and obesity have a deleterious impact on microbiomes in the stomach and intestine. Apart from that, there is no noticeable negative impact on the digestive system.[17-19] On the other hand, coffee and other beverages containing easily oxidized phenolic compounds may dramatically enhance human exposure to carcinogenic N-nitrosamines by accelerating their production both in meals and in the digestive system. At stomach pH, oxidized phenolic substances function as catalysts more than inhibitors for the synthesis of N-nitrosamine from nitrile salt and secondary amines.[20]

The intestinal stage may be the primary biological site of action for antioxidant coffee components.

Melanoidins found in coffee may be processed by the microbiota in the colon, producing a number of metabolites and liver metabolites such as aglycone, sulfate, glucuronide, and methyl with increased antioxidant activity and more positive benefits. Coffee brews may be a good source of key active chemicals, such as free CGAs, caffeine, and melanoidins. Coffee polyphenol bioaccessibility and antioxidant capacity rise considerably after the colonic stage in all coffee brews. The amounts of CGAs observed in coffee brew samples are greater in coffee espresso than in other coffee brews. Through a well-mouse model of experimental colitis, chlorogenic acid demonstrated considerable anti-inflammatory action, as indicated by a reduction in the macroscopic damage score, myeloperoxidase activity, and suppression of the NF-kappa B-dependent pathway. The repression of cyclooxygenase-2, inducible nitric oxide synthase, and the absence of cytotoxicity, the suppression of interleukin (IL)-1 and IL-6, and tumor necrosis factor-alpha inhibition and inhibition of NF-kappa B in dextran sulfate sodium-induced colitis by chlorogenic acid have been observed in new research.[21,22]

The gut microbiota and brain interactions are inextricably linked. According to this information, coffee use changes the microbiome, and their metabolites change the concentration of neurotransmitters in the brain. Studies have shown regular coffee drinkers, and the study is conducted under non-stressful settings. Thus, coffee has no influence on self-reported anxiety levels.[23-25]

The major psychoactive component present in coffee is caffeine. It is ingested and absorbed into the bloodstream, stimulating the sympathetic nervous system and quickly crossing the blood-brain barrier, having stimulatory effects on the central nervous system (CNS). Caffeine affects the CNS by altering several neural pathways. Drinking coffee has a favorable immediate effect and stimulates neurotransmitters.[26,27] Caffeine exposure has been detected. Caffeine, according to several studies, increases extracellular dopamine concentrations as well as the expression of dopaminergic receptors and transporters, which improves cognitive impairment and attention.[28-31]

Dopaminergic activity, on the other hand, is elevated in schizophrenia and addictions. Importantly, patients with schizophrenia consume relatively large amounts of coffee and caffeine for a variety of reasons, including a desire to alleviate boredom and apathy or antipsychotic drug side effects such as sleepiness or dry mouth.[32]

Liver Disease Risk

The liver is the vital organ that regulates all systems of the body. It has many factors that may affect negatively, especially dietary is studied. Coffee consumption is one of them because of the most consumed beverage all over the world. According to studies, both negative and positive impacts are considered. Due to the phenolic compounds of coffee, and their metabolites in the liver show protection against liver cancer and regenerative effects on liver diseases such as hepatitis B and C, nonalcoholic fatty liver disease and alcoholic liver disease, and for hepatic fibrosis and cirrhosis. The decreased liver stiffness via coffee bioactive compounds may indicate less fibrosis and inflammation. Using liver fibrositic rodent models, the beneficial effect of caffeine was investigated. So, the caffeine blocks the toxin-induced liver fibrosis and cirrhosis and inhibits hepatic stellate cell activation via blocking A2A receptors. Chlorogenic acid has a hepatoprotective nature, so diterpene cafestol and kahweol offer inhibitory effects at aflatoxin β-induced liver damage. Also, diterpene cafestol and kahweol induce the synthesis of glutathione. The quantity of coffee drinks also affects. It reduces fibrosis cirrhosis, carcinoma rates, and mortality. Liver metabolites serotonin are synthesized by stimulation of coffee. The negative impacts of coffee metabolites are the high production of bile acid, causing agent liver cancer and liver disease death. On the other side, chlorogenic acid reduces colon carcinogenesis related with bile-acid induction, and cafestol suppresses excess bile-acid synthesis.[15,33]

Type 2 Diabetes

Increasing coffee-related studies, particularly in recent years, have revealed that coffee has a very broad effect area. Especially protective and regenerative features lead to more detailed research such as metabolic disease, and type 2 diabetes. Chlorogenic acid shows multiple positive effects such as inhibition of gluconeogenesis by changing activity and expression of glucose-6-phosphatase, and improvement of muscle glucose uptake by rising expression and translocation of GLUT4. Polyphenols of coffee also stimulate GLP1 hormone and then, glucose-induced insulin secretion is activated by β-cells. The excess stimulated GLP1 signal reduces diabetes in animals and in human studies. After that, the insulin sensitivity rises to the normal level. During the Coronavirus disease 2019 pandemic, many routines were changed, including dietary, and physical education. The body could adapt to these

changes. Some harm was done to the body as a result of weight increase while remaining inactive and eating irregularly. Type 2 diabetes cardiovascular disorders are one of them. The rise in coffee intake had a clearer influence on illnesses throughout this process. Still, there is not enough data to evaluate and examine the total effects, yet.[15,34]

Breast Cancer Risk

The cancer incidence effect of coffee consumption was studied on 21 volunteer women who consumed at least two cups of coffee per day while many options were being considered such as age-dependent, premenopausal, and postmenopausal periods, body mass, alcohol intake, etc. There are many options to predict exact results, minor components of coffee which are also important as well as coffee major components importance, and the variety of coffee studied. Considering this, regular coffee intake does not affect breast cancer (BC), especially for premenopausal women. On the other hand, regular coffee consumption is associated with a lower risk of postmenopausal BC. The estrogen receptor (ER) is an important indicator because the estrogen-dependent study reported the inverse relation between coffee consumption and ER-BC. When it is summarized previous studies are evidence that coffee intake interaction with the menopausal period significantly affects BC occurrence.[35-37]

In conclusion, coffee components are influenced at practically every stage. Coffee drink preparation procedures, such as filtering, brewing, and so on, might affect the percentage of bioactive components in coffee. Coffee phenolic chemicals, melanoidins, CGAs, kahweol, and other metabolites have an effect on such organs and systems. If treatment is to be established, gender differences and changes in parameters via steroid hormones are also relevant. To remedy the implication, all aspects of coffee and its components that have a detrimental impact on materials such as eating style, smoking, stressing, and hereditary traits of persons must be evaluated. As a result, the study range and more detailed investigation provide extensive data. Each of the body's systems is linked to the others. A narrow frame of view reveals the unknown complicated interaction between those systems.

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