Coffee Consumption Benefits and Risks on Human Health

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ABSTRACT

OBJECTIVE

To review researches done on coffee consumption benefits and risks on human health.

RESULTS

Coffee has many chemical compounds like caffeine, diterpene, alcohols, and chlorogenic acid, that make it valuable for human health when used at per recommended level. Consumption of 3 up to 5 cups as standard daily is believed to prevent different kinds of chronic illnesses. The coffee drink is linked with the prevention of several illnesses, including Parkinson's disease, liver disease, and Diabetes mellitus, helps to burn fat, increases our physical routine, boosts mood, and decreases depression and suicide risk. It also reduces the risk of dementia, stroke, colorectal, and prostate cancer. Side effects are related to overdrinking and it can be controlled by consuming an appropriate amount of coffee in a day. Some groups, including people with hypertension, pregnant women, children, and the elderly are prone to the side effects of coffee and they have to limit their intake. Even though coffee has been associated with a lot of health benefits, more research is needed to identify its effect on health, possible future use as a remedy, and safe level of consumption considering its preparation and factors like age, sex, and different health issues.

KEYWORDS

Benefits; Coffee; Consumption; Human health; Risks

INTRODUCTION

Coffee is the most regularly consumed, pharmacologically active caffeine-containing beverage and the second most traded commodity next to edible oil [1]. It was discovered in Africa and through time distributed to different countries around the globe [2].

Coffea arabica L. is classified under the genus Coffea, and the *Rubiaceae* family [3]. Arabica coffee is highly observed due to its high quality of test and it accounts for about 64% of the world's total coffee production [4]. Coffee drinking is a vital regular part of daily life and most people start a day with coffee [5].

Consumers drink coffee for energy and pleasure [6]. Most caffeine is consumed in the morning hours, often at breakfast, when alertness is lowest, and very little in the evening before sleep [7].

The Active Ingredients of Coffee

Coffee is a complex beverage containing >1,000 compounds and the main constituents are caffeine, diterpene alcohols, chlorogenic acid and also minerals, carbohydrates, proteins, and lipids [9]. Several micronutrients are found in coffee, including magnesium, potassium, niacin, and vitamin E [9]. These compounds make coffee exert its biological effect on the physiological action of our body.

Coffee's Mechanisms of Action

The favorable effect of coffee is explained by many reasonable mechanisms due to the existence of a diversity of biological constituents [1]. The top identified compound is caffeine (1,3,7-trimethylxanthine) due to its physiological effects as a bronchodilator, stimulant of the central nervous system, and causing increment in blood circulation, and respiration [10]. It is the key compound thru which coffee can influence many pathways in our body system.

Coffee has a tremendous impact on reducing the genesis and progression of different diseases through its anti-oxidant and anti-inflammatory properties and also by inhibiting carcinogenesis. Coffee beans contain phenolic antioxidant compounds and the major polyphenol is chlorogenic acid [5]. Chlorogenic acid compounds are recognized to contribute significantly to the antioxidant property of coffee [11]. It also activates the endogenous antioxidant defense system by increasing plasma levels of glutathione [12]. Cafestol and kahweol also can regulate a variety of inflammatory mediators to reduce inflammation [13]. In addition, the two coffee diterpenes can prevent cancer from occurring by blocking the activation of carcinogens and improving liver detoxification function and they can also inhibit tumor cell proliferation and angiogenesis [13].

Pharmacokinetics

Caffeine is quickly and almost completely absorbed in the stomach and small intestine and then goes to all tissues, including the brain [14]. For humans, it takes around 15 to 120 minutes from the point of oral intake to the peak level of concentration in plasma [15]. Caffeine is metabolized in the liver by cytochrome P-450 (CYP) enzymes, in particular, CYP1A2 [16]. In adults, caffeine is metabolized to 1-methyl uric acid and 1-methylxanthine, and only one to five percent of consumed caffeine is found in the urine unchanged [17].

The elimination half-life of caffeine ranges between 3 and 7 hours and can be influenced by many factors, including sex, age, use of oral contraceptives, pregnancy, and smoking, and its half-life has been reported to be 20-30% shorter in females than in males [17]. Smoking greatly accelerates caffeine metabolism, reducing the half-life by up to 50%, whereas oral contraceptive use doubles the half-life of caffeine [16]. Pregnancy greatly reduces caffeine metabolism, especially in the third trimester, when the half-life of caffeine can be up to 15 hours [16]. And also, several quinolone antibacterial agents, including pefloxacin, ciprofloxacin, enoxacin, and pipemidic acid, have been seen to reduce methylxanthine clearance [15].

Coffee itself can affect some other drugs, hence caffeine may inhibit the hepatic metabolism of the antipsychotic medications, decrease the elimination of theophylline increase the risk of toxicity of these drugs, and decreases serum concentrations of lithium by enhancing its elimination [9]. Thus, patients on antipsychotic drugs and lithium should limit their coffee intake.

Different Ways of Coffee Preparations

The caffeine content of coffee is dependent on its method of preparation and the product brand [17]. Depending on the brewing processes, three major types of coffee can be distinguished: (i) boiled unfiltered coffee, (ii) filtered coffee, and (iii) decaffeinated coffee (DC) [18].

A higher amount of titratable acids like caffeoylquinic acid and antioxidant properties are found in hot brew coffee, than that in the cold brew [11]. Roasting and processing methods may degrade several compounds, like antioxidant polyphenols and others that might be an important determinant for coffee functions.

Safety Standard

Coffee intake is determined by coffee cup size, the concentration of the brew, and frequency of consumption [5]. In epidemiological studies, one cup is often assumed to provide 85mg-100 mg of caffeine [9]. But, cup size may vary based on the population and the concentration of caffeine can vary on its preparation [9]. In healthy people between the age of 18 and 65, a daily dosage of 400 mg of caffeine does not increase well-being worries according to European Food Safety Authority [19]. Consumption of 2 up to 3 cups in a day is safe and has no side effects to beneficial according to various health studies [8]. But these estimations didn't consider age, sex, and other health issues.

Uses of Coffee for Human Health

Most research done previously suggests long-term coffee consumption can decrease the risk of many diseases and its effects depend on the up-on amount of caffeine contained, sex, age, and diet [20]. Regular coffee consumption is linked to reducing the risk of many chronic diseases [16]. Coffee effects have been ascribed to many different bioactive elements of coffee, including, phenolics, polyphenol, diterpenes, methylxanthine, and others, some of which can have also large synergetic effects [21].

Coffee affects the central nervous system

The central nervous system is stimulated by Caffeine by three mechanisms: inhibiting phosphodiesterase, blocking adenosine receptors (an endogenous inhibitory neuromodulator that prompts feelings of drowsiness), and mobilizing intracellular calcium storage [15]. Decaffeinated coffee enriched in chlorogenic acids can improve alertness, and reduce headaches and mental fatigue in comparison to non-enriched decaffeinated coffee [22]. Coffee helps to prevent degenerative disorders, many of which are related to neuro stimulating, anti-oxidant, and anti-inflammatory effects [22]. Drinking 2 up to 3 cups of coffee per day is linked with about 30% lower risk of stroke and dementia [23]. A moderate intake of coffee improves brain function and reduces the risk of developing Alzheimer's disease, and dementia, and also assists with the prevention of Parkinson's disease by reducing its risk by 30- 60% [19].

Coffee Effects on the Cardiovascular System

Most studies have focused on the connotation of the intake of coffee and its influences on cardiovascular risk factors including obesity, high blood pressure, high serum glucose, and serum cholesterol level [8]. Coffee consumption has a potential favorable impact on the metabolism of lipid regulation and markers related to inflammation [24]. And also, caffeine appears to improve vascular function by reducing reactive oxygen species production and enhancing nitric oxide bioavailability [12].

Coffee Effects on Diabetes Mellitus

Coffee drinking is linked with a lower risk of type 2 diabetes [25]. Mechanisms are inhibition of the glucose-6-phosphatase, inhibition of intestinal glucose absorption by phenolic compounds like chlorogenic acid, and also by increasing energy expenditure and inducing weight loss [9]. Several epidemiological studies suggest that long-term, usual coffee drinking may help to maintain normal glucose tolerance [9]. So, it is significantly associated

with a decrease in all-cause mortality caused by type 2 diabetes [26].

Coffee Effects on Gastrointestinal System

Research done on epidemiology suggested that coffee brew may exert multiple effects on the digestive tract, including antioxidant, anti-inflammatory, and anti-proliferative effects on the mucosa, and pro-motility effects on the muscle layers [27]. Useful relations between coffee drinking and liver function are comparatively large [28]. Caffeine's antioxidant and anti-inflammatory properties reduce the risk of liver disease (cirrhosis, fibrogenesis, nonalcoholic fatty liver disease) [20]. All types of coffee have a significant effect on preventing the occurrence and progression of chronic liver disease [29]. The melanoidins in coffee may have an influence on liver fat and they can function as an antioxidant quenching radical and improve the reduced/oxidized glutathione balance in the colon [22]. In addition to this drinking coffee is linked with reductions in risks allied with the gallbladder such as gallstones and pancreatitis [12]. The consumption of ≥2 cups of coffee/d may reduce the risk of end stage renal disease in the general population, especially among men [30].

Coffee Effects on Cancer

Several constituents of coffee have been found to play a protective role against cancer and the most well-known is chlorogenic acids [31]. The moderate drinking of coffee particularly caffeinated coffee range 1 up to 6.5 cups per day is accompanied by a lower all-cause and cancer death [31].

Coffee Effects on Sport

Caffeine is also widely consumed by athletes as an ergogenic boost and as a psychoactive drug because it can augment alertness, enhance concentration and diminish fatigue [15]. By stimulating the nervous system, caffeine helps to make free fatty acids available from fat cells and these free fatty acids are then available to the body as a source of energy to fuel exercise. Coffee increases the amount of fat utilized during continuous aerobic exercise supporting the use of caffeine as an ergogenic aid during training or competition [32].

Adverse Health Outcomes Associated with Coffee

Although coffee drinking has been linked with health benefits, it can also have side effects related to a high level of consumption. Some groups, including people with hypertension, children, pregnant women, and the elderly may be more prone to the adverse effects of caffeine.

Even potentially small health benefits or risks associated with coffee intake may have important public health implications given its widespread popularity [8]. Some people report experiencing irregular heartbeat or headaches and are thus reluctant to drink coffee, which suggests variation among individuals to coffee intolerance [5]. Side effects include anxiety, insomnia, palpitation, as well as bone loss, and possibly increased risk of fractures [8]. Additionally, it reduces appetite level for food and causes restlessness and [1]. Symptoms of caffeine overdose may include agitation, delirium, seizures, dyspnea, cardiac arrhythmia, myoclonus, nausea, vomiting, hyperglycemia, and hypokalemia [9]. Caffeine poisoning from the consumption of traditional sources of caffeine is rare because a very large amount (75 to 100 standard cups of coffee) would have to be consumed in a short time for the dose to be fatal [16].

Coffee Affects Blood pressure and Cardiovascular System

The cardiovascular system is one of the most vulnerable to the negative effects of caffeine. Caffeine is the major acute blood pressure increasing compound found in coffee in non-habitual drinkers, but not in the habitual coffee drinkers and other compounds present in coffee may counteract these acute pressor effects [8]. The acute effects of coffee on the cardiovascular system might arise in the time immediately after coffee intake or in more

susceptible individuals [5]. Most studies show coffee increases blood pressure in patients having hypertension and it is advised to decrease coffee intake in this group of individuals.

Coffee Effect on Cholesterol

Studies have reported that the cafestol, diterpenes, and to a lesser extent, kahweol, found in coffee naturally can alter lipid enzymes and thus influence cholesterol levels, and also boiled coffee has a pronounced effect because of the higher concentration of diterpenes found in it [17]. Coffee drinking particularly unfiltered coffee is significantly contributed to increasing the total cholesterol, and low density of triglyceride and lipoprotein. So, people with abnormal lipid profiles have to consider using filtered coffee as opposed to preparations made without filtering.

How Coffee Affects Bone and Calcium

Drinking caffeine-containing beverages is linked with an increased risk of bone mass loss and fracture [33]. Uncompensated losses of calcium would be a dangerous issue aimed at the development of osteoporosis [34]. Caffeine leads to a slight decrease in the effectiveness of calcium absorption in the gastrointestinal tract [5]. Nevertheless, much evidence displayed that this effect is through caffeine-induced hypercalciuria [17].

This effect is biologically more relevant in women and it has deleterious effects especially in adult women because they don't consume enough amount of calcium to compensate adequately to maintain their calcium balance [34]. Evidence does not exist on caffeine's negative consequence on bone conditions of individuals who ingested the presently suggested day-to-day allowances of calcium [33]. So, drinkers of caffeinated coffee in particular are advised to ensure adequate calcium intake to minimize this side effect.

Influences of Coffee on Sleep

Caffeinated coffee can cause irritability and anxiety and reduce sleep quality by increasing the time required to fall asleep, interfering with the deepness of sleep, and reducing the total time spent sleeping [22]. If caffeine consumption is not properly regulated during the first daytime, sleep deprivation will be unsure and the performance deficits will be experienced during the subsequent daytime [35]. The interpersonal disparity in the effects of caffeine on sleep and anxiety is large [16]. For example, older adults 'sleep is more sensitive to coffee consumption as compared to teenagers [1].

Causing Dependency

The most widely used stimulant around the globe is caffeine and its dependence is a common issue, even overnight caffeine deprivation produces negative impacts on the mood that could be reversed by caffeine consumption [35]. Tolerance to caffeine may depend upon behavioral or biological effects made by caffeine level and patterns of consumption [17].

When withdrawal occurs, it is short-lived and relatively mild in the majority of people affected [17]. Significant withdrawal symptoms have been observed at long-term intakes as low as 100 mg/d, although they are more common through huge consumption [9]. Commonly reported caffeine withdrawal symptoms are headaches, fatigue, drowsiness, irritability, depressed mood, and difficulty concentrating [9]. These symptoms typically peak for 1 to 2 days after cessation of caffeine intake, with a total duration of 2 to 9 days, and can be reduced by gradually decreasing the caffeine dose [16].

Adverse effects of Coffee on the Gastrointestinal System

Coffee has been suggested as a trigger for some common digestive complaints like stomach aches and heartburn [12]. The tightness of the lower esophageal sphincter may be reduced by the consumption of coffee leading to the exacerbation of gastroesophageal reflux disease [36].

A few compounds in coffee like Chlorogenic acids, Nβ-alkanoyl-5-hydroxytryptamine (C5HTs) from coffee wax, and to a lesser extent, caffeine, stimulate the production of gastric juice [22]. Gastric acid secretion may vary depending on the roasting of the coffee consumed [12]. Compared to caffeinated one, decaffeinated coffee is linked with less reflux [37]. So, decaffeinated coffee can be an option for people who have gastroesophageal reflux disease. Coffee decreases iron absorption and zinc bioavailability, so to maximize iron and zinc absorption from a meal or supplements, concomitant intake of coffee should be avoided [9].

Coffee Effects on Children

A large amount of caffeine is not recommended for adolescents and young children and as European Food Safety Authority, recommended safe level is a limit of 3 mg per kg between the ages of 3 to 18 years [19]. Protracted nervous system development may render children highly sensitive to adverse influences of caffeine [17].

Coffee Effects on Pregnant Women

Consumption of caffeine in mothers has continually been linked to babies being born with lower birth weight [38]. Caffeine can easily cross the placenta thus, affecting fetal growth [39]. During pregnancy caffeine consumption at dose levels of >300, mg/day may interfere with fetal growth, particularly in smokers or heavy alcohol drinkers [17]. High caffeine consumption in pregnant mothers increases the risk of intrauterine growth retardation, miscarriage, and stillbirth [40].

Caffeine may also block specific adenosine receptors, as adenosine is involved in maintaining the balance between the availability and the use of tissue oxygen, blockage of its receptors could increase the susceptibility of the cell to hypoxia [17]. An intake of below 200 mg is approved as a safe level by European Food Safety Authority, however, to be cautious it is advisable to keep consumption as low as possible [19].

Coffee Effects on Reproduction

Coffee can decrease fertility in both sexes [1]. Based on data available from epidemiological studies, it may be prudent for women who plan to be pregnant and who are having difficulty conceiving to limit caffeine consumption to less than 300 mg/d in addition to stopping using tobacco and decreasing alcohol consumption [9]. And also in males, ingested caffeine is capable of crossing the blood-testis barrier [17]. Consumption of caffeine in males was hypothesized that affects the integrity of sperm's DNA and also semen parameters [41]. Caffeine consumption at dose levels of >400 mg/day may decrease sperm motility and/or increase the percentage of dead spermatozoa (only in heavy smokers) but will be unlikely to adversely affect male fertility in general [17].

Coffee Effects on Urinary System

The consumption of massive amounts of caffeine can lead to severe hypokalemia by increasing the loss of potassium in urine due to the diuretic effect [42]. It also increases urinary excretion of chloride, magnesium, and sodium and this process persist for at least 3 hours after consumption [36]. Excessive caffeine intake (>400 mg/day) may elevate the problems of detrusor instability (unstable bladder) development in women [17]. Women mostly experience urinary incontinence problems [20]. Studies on invitro culture cells reported that caffeine has been proposed to accelerate the progression of autosomal dominant polycystic kidney disease by increasing the size of the kidney but, this effect is not detrimental [43].

DISCUSSION

Coffee effects on human health have now become the subject of systematic research to identify the association between coffee as exposure and a range of outcomes. Coffee drinking gives several benefits for human health that have been proven and health benefits outweigh the

risks of moderate coffee consumption for the majority of health consequences considered. coffee consumption may support the prevention of numerous long-lasting illnesses; including type two diabetes mellitus, Parkinson's disease, and liver disease (cirrhosis and hepatocellular carcinoma) as Epidemiological research results suggested [14]. It increases our physical performance, burn fat, reduces the risks of stroke, liver, prostate, and colorectal cancer by 20%, the risk of Parkinson's disease by 25%, lowers the risk of Type II diabetes, reduces the risk of dementia, and protects our mind, brightens our mood, helps us to fight depression and minimize the risk of suicide by 50% [1].

Coffee supports increasing the quantity of certain important neurotransmitters which improves memory, general cognitive functions, and moods. Coffee has a bioactive compound called caffeine which stimulates the human brain and spinal cord and has positive effects on long-term memory [1]. In contrast to this, Patocka et al. [15] declared that drinking coffee has little to no impact on human long-term memory, and tasks that rely on working memory may be hindered because of it [20]. specified that at the low dose, it has been reported that caffeine has a positive consequence on cognitive performance, brain function, and memory, but at higher doses, it may be responsible for nervousness and anxiety. Epidemiological studies suggested that caffeine consumption decreases the risks of Parkinson's disease and delays its development of it [8,22]. Coffee consumption reduces the risks of overall stroke, especially ischemic stroke [44]. A study was done on middle-aged Korean women by Lee et al., 2017 also suggests that higher coffee consumption may have protective benefits concerning stroke risk.

Drinkers of coffee are less likely to be depressed than about;10 to 20%, they are also about half as likely to commit suicide [19]. But studies were done by Nawrot et al. [17] and Hl et al. [45] suggest that chronic and heavy caffeine ingestion may cause or exacerbate anxiety in adults with pre-existing anxiety disorders and panic in panic disorder patients and may be associated with depression and increased use of anti-anxiety drugs.

Coffee consumption may also help ameliorate metabolic syndromes and their associated complications such as obesity, diabetes, inflammation, and cardiovascular diseases [18]. Following this, a study done by Chen et al. [46] also reported that overall coffee consumption was not correlated with Metabolic syndrome. Research done by Cheung et al. shows that the consumption of coffee did not significantly affect LDL-C levels. Also, in agreement with this, research done on rats by Feyisa et al. [18] concluded that treating rats with coffee decreased body weight, fasting serum glucose, uric acid, TC, TG, and LDL-C, and increased HDL-C in a dose-dependent manner.

Moderate coffee intake is positively associated with cardiovascular health and does not increase the risk of heart disease [24]. Decaffeinated coffee intake was also associated with reduced risk of all-cause and CVD mortality, indicating that components of coffee other than caffeine are likely driving the coffee and mortality connection [47]. Similarly, Ghavami et al. suggest that increasing coffee consumption may reduce the major and important CVD risk factors among the elderly with T2DM. On contrary, a study by Taylor et al. [14] shows that coffee consumption is associated with increases in several cardiovascular disease risk factors, including blood pressure and plasma homocysteine. The results of the acute studies indicate that caffeine induces an increase in systolic and/or diastolic blood pressure especially in elderly, hypertensive, or caffeine-naive individuals, but it is only acute and self-limiting [8,17].

Even though some results show coffee interferes with bone physiology and may lead to a greater risk of bone fracture, others reported contrasting findings. Even if more drinking of coffee may be allied to a modest

decrease in bone mineral density the evidence did not exist of a substantially increased incidence of osteoporosis or fractures typically associated with osteoporosis [48]. Furthermore, coffee's antioxidant effects help decrease the risks of osteoporosis [36,49]. A study by Yu et al. suggests, that a slight increase in coffee intake might be beneficial in the prevention of osteoporosis among Chinese men. And also, a study done on Korean postmenopausal women within moderate ranges of consumption reported that coffee was inversely associated with osteoporosis and directly associated with bone mineral density [49].

Additionally, currently available evidence suggests that ensuring adequate calcium and vitamin D intake and limiting coffee consumption to 3 cups/d (300 mg/d of caffeine) may help reduce the risk of osteoporosis and osteoporotic fractures, particularly in older adults [9,17,33,34]. Coffee has long been associated with indigestion, heartburn, and other gastrointestinal symptoms [11]. But, Carlo et al., [12] mentioned that coffee is not a major trigger of heartburn.

Caffeine is not likely to be a human carcinogen at a dose of fewer than 5 cups of coffee per 0mg caffeine/day) [17]. At present, there is little evidence that coffee consumption increases the risk of cancer [14]. But, compared with no-consumption, coffee consumption of one or fewer cups per associated with a reduction in all-cause mortality, and a reduction in cancer mortality [31]. Due to its antioxidant effect, coffee is associated with decreased incidence of brain cancer, skin, liver, and colorectal cancers [19], a small reduction in the risk of hepatocellular cancer, and possibly breast cancer [50]. In a study done by Li et al. [51], a high daily intake of coffee was found to be associated with a significant decrease in ER-negative breast cancer among postmenopausal women. And also, Gavrilyuk et al. report shows, that in a population with high coffee consumption, endometrial cancer risk

decreases in women consuming ≥8 cups/day, independent of the brewing method.

Caffeine intake was consistently associated with decreased birth weight and increased odds of small for gestational age neonates [52]. There is a linear association with low birth weight across the range of caffeine intakes [53]. A study by Choi et al. [39], on pregnant Korean women shows that heavy coffee drinking was independently associated with a higher risk of bleeding in early pregnancy. Currently, available evidence suggests that it may be prudent for pregnant women to limit coffee consumption to 3 cups/d providing no more than 300 mg/d of caffeine to exclude any increased probability of spontaneous abortion or impaired fetal growth [14].

According to Hinkle et al. study, coffee is not associated with gestational hypertension or preeclampsia it lowers the risk for gestational diabetes mellitus and there was no association to miscarriage, preterm delivery, or intrauterine growth restriction experientially checked at levels less than 200mg/d. On a contrary to this, even if it's less than the recommended 200mg per day, coffee boots the risks for lower birth and other poor outcomes [52,53].

Caffeine acting as an antioxidant can suppress skin damage induced by ultraviolet and thus protect skin cells from UV irradiation-induced oxidative stress [20]. Furthermore, caffeine's vasoconstrictive and immune suppressive effects might reduce the risks of rosacea [54]. Caffeine can contribute to pain relief when added to commonly used analgesic agents [16]. It has been found to decrease the systemic elimination of acetaminophen and to increase the bioavailability of aspirin, which may partially explain its efficacy in enhancing its analgesic effects [9]. In a study done by Strom et al. on individuals with a lot of office work, subjects who had consumed coffee before starting a pain-provoking office work task exhibited attenuated pain development compared with the subjects who had abstained from coffee intake.

Results and generalizations about the effect of coffee on health are complicated by many factors, including differences in age, gender, health status, type of coffee preparation, serving size, source of coffee, and other confounding factors like smoking [21]. Current evidence does not warrant recommending caffeine or coffee intake for disease prevention but suggests that moderate consumption of coffee can be part of a healthy lifestyle [16]. The moderate consumption of caffeine in normal adults has not been associated with any major adverse effects on mood or performance and most effects associated with higher consumption rates would be self-limiting [17].

CONCLUDING REMARKS AND FUTURE DIRECTION

In conclusion, coffee has many health benefits in every system of our body; but its side effects are related to an overdrinking or high levels of drinking and it can be controlled by consuming an appropriate recommended number of cups of coffee in daily life. Pregnant women, children, and old people are prone to the sideways effects of coffee and they have to limit their daily intake. Consumers only use coffee as a stimulant or for recreation purposes. So, it is important to educate based on the scientific evidence- about the health benefits of coffee and an appropriate level to consume. Even though coffee has been associated with a lot of health benefits, more research is needed to identify its side effect on health, possible future use as a remedy, and safe level of consumption considering its preparation and factors like age, sex, and different health issues, preparation procedures, and all materials used should be studied for different species at different agro-ecologies of different countries. In addition to this phytochemical analysis and each chemical, concentration should be compared with recommended standards for perfect human health in daily life, storage time, and packing materials and their side effects on coffee phytochemicals should be studied for all species of coffee in different parts of the world.

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AUTHORS CONTRIBUTIONS

Researcher Kasim Roba created the idea to be revied based on the personal observation that many people were suffering from gastric pain and hate drinking coffee. Dr. Zemzem Ahmed downloaded many journals and wrote the manuscript. Researcher Kasim corrected the whole paper and checked it together with Dr. Zemzem. All authors read and approved the final manuscript.

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