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COMPARATIVE STUDY BETWEEN COFFEE AND TEA

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

طسم(1) تِلْكَ آيَاتُ الْكِتَابِ الْمُبِينِ(2) لَعَلَّكَ بَاخِعٌ نَفْسَكَ أَلَّا يَكُونُوا مُؤْمِنِينَ(3) إِنْ نَشَأْ نُنَزِّلْ عَلَيْهِمْ مِنَ السَّمَاءِ آيَةً فَظَلَّتْ أَعْنَاقُهُمْ لَهَا خَاضِعِينَ(4) وَمَا يَأْتِيهِمْ مِنْ ذِكْرٍ مِنَ الرَّحْمَنِ مُحْدَثٍ إِلَّا كَانُوا عَنْهُ مُعْرِضِينَ(5) فَقَدْ كَذَّبُوا فَسَيَأْتِيهِمْ أَنْبَاءُ مَا كَانُوا بِهِ يَسْتَهْزِئُونَ(6) أَوَلَمْ يَرَوْا إِلَى الْأَرْضِ كَمْ أَنْبَتْنَا فِيهَا مِنْ كُلِّ زَوْجٍ كَرِيمٍ(7) إِنَّ فِي ذَلِكَ لَآيَةً وَمَا كَانَ أَكْثَرُهُمْ مُؤْمِنِينَ(8) وَإِنَّ رَبَّكَ لَهُوَ الْعَزِيزُ الرَّحِيمُ(9) وَإِذْ نَادَى رَبُّكَ مُوسَى أَنِ ائْتِ الْقَوْمَ الظَّالِمِينَ (10) قَوْمَ فِرْعَوْنَ أَلَا يَتَّقُونَ(11) قَالَ رَبِّ إِنِّي أَخَافُ أَنْ يُكَذِّبُونِ(12) وَيَضِيقُ صَدْرِي وَلَا يَنْطَلِقُ لِسَانِي فَأَرْسِلْ إِلَى هَارُونَ(13) وَلَهُمْ عَلَيَّ ذَنْبٌ فَأَخَافُ أَنْ يَقْتُلُونِ(14) قَالَ كَلَّا فَاذْهَبَا بِآيَاتِنَا إِنَّا مَعَكُمْ مُسْتَمِعُونَ(15) فَأْتِيَا فِرْعَوْنَ فَقُولَا إِنَّا رَسُولُ رَبِّ الْعَالَمِينَ(16) أَنْ أَرْسِلْ مَعَنَا بَنِي إِسْرَائِيلَ(17) قَالَ أَلَمْ نُرَبِّكَ فِينَا وَلِيدًا وَلَبِثْتَ فِينَا مِنْ عُمُرِكَ سِنِينَ(18) وَفَعَلْتَ فَعْلَتَكَ الَّتِي فَعَلْتَ وَأَنْتَ مِنَ الْكَافِرِينَ(19) قَالَ فَعَلْتُهَا إِذًا وَأَنَا مِنَ الضَّالِّينَ(20) فَفَرَرْتُ مِنْكُمْ لَمَّا خِفْتُكُمْ فَوَهَبَ لِي رَبِّي حُكْمًا وَجَعَلَنِي مِنَ الْمُرْسَلِينَ (21)

صدق الله العلي العظيم

Abstract :

Coffee and tea are among the most widely consumed beverages in the world. This study highlights the use of these beverages among the people in Hilla / Iraq , with the participation of 300 people of both sexes (male and female). The study included four age groups (>20, 20-40, 41-60, >60), the number of male participants was only 95, with a ratio of 31.66%, while the number of females reached 205 and the participation rate was 68.33 %. The total number of male and female from participants that prefer drinking tea is 203 individuals while the total number of participants that prefer drinking coffee is 97 individuals. the total number of participants that preferred to drink tea or coffee with sugar is (266), while, the total number of participants that preferred to drink tea or coffee without sugar is (34). The total of males and females who feel with a side effects when drinking coffee was 77 , while side effects when drinking tea is 40.

Introduction

Coffee and tea are among the most widely consumed beverages in adults worldwide [1, 2]. Coffee consumption is very popular and still increasing, with the highest per capita consumption in Scandinavian countries in 2013 [3]. Tea (black or green) is worldwide the most commonly consumed beverage after water, with high per capita consumption observed in Turkey, Iran, and United Kingdom [3]. There is a long-standing interest in the health effects of coffee and tea. Epidemiological studies have been conducted on coffee or tea intake and disease incidence (e.g. cancer, CVD, diabetes) and mortality. A recent meta-analysis on coffee and mortality in 31 cohort studies [4] showed decreased overall and cardiovascular disease (CVD) mortality for coffee consumption of up to 4 cups/day. Two recent large cohort studies also showed that coffee consumption was associated with reduced risk of death (overall and from various causes) in the European Prospective Investigation into Cancer (EPIC) [5] and among African Americans, Japanese Americans, Latinos and whites in the Multiethnic Cohort (MEC) [6]. For tea, a recent meta-analysis using 18 cohort studies found that black tea consumption was significantly inversely associated with overall and cancer mortality, while green tea consumption was significantly inversely associated with overall and CVD mortality [7]. Only in a limited number of the previous cohort studies on mortality, analyses for coffee and tea intake were mutually adjusted. While coffee and tea are both drunk in most countries, usually one predominates because of economic (e.g., trade and income), marketing, cultural and ethnic reasons [8]. Many people can choose between coffee and tea, and drink these in varying ratios depending on taste preference, lifestyle, socio-economic factors, genetics and health.

1- Coffee

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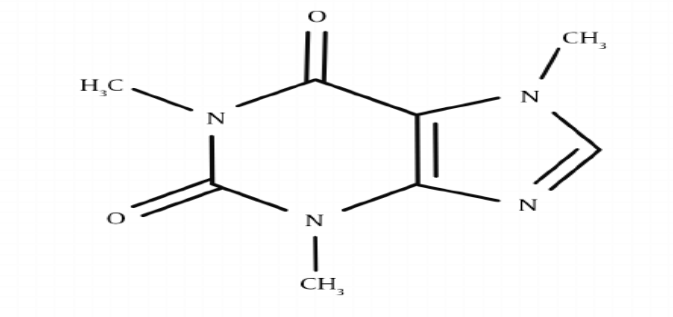
Coffee is a popular beverage that is widely consumed around the world [9, 10]. Since its introduction into Arabia from Ethiopia many centuries ago [11], its cultivation has continued to blossom in three regions of our globe, namely, Africa, Latin America and Asia, [12–13]. Coffee is often produced from the roasted beans of a great variety of coffee crops [14]. However, Coffea *canephore and Coffea arabica* are the two most economically important species [15, 16]. It can now be found in both organic and conventional types [17]. Presently, the largest coffee bean producing region is Latin America [18], leading to an immense boost in the economy of the respective countries by bringing in the much-needed foreign exchange. Unfortunately, market shocks, extreme weather conditions, and pests are an enormous challenge to this reality [19, 20]. World prices of coffee beans vary reasonably with their geographical source, as this affects the physical presentation of these beans and their nutritive components, two factors that are important in determination of coffee quality [21–22]. There are many nutritive substances in coffee brews which vary with the types of techniques employed in brewing processes [23]. Coffee contains mineral ingredients such as Ca, K, Fe, P, Ni, Mg, and Cr [24], polyphenols, caffeine, melanoidins, and carbohydrates [25,26].

a. Bioactive Compounds of Coffee

Coffee is rich in many bioactive substances and its consumption has been associated with many beneficial effects [27]. These include, but not limited to, reduced risk of hepatocellular carcinoma [28], antiproliferative effect against some human cancer cell lines [29], therapeutic potential against Alzheimer's disease [30], and antioxidant capacity through modulation of Nrf2 nuclear translocation [31]. *2.1. Caffeine.* Caffeine ($C_8H_{10}N_4O_2$), an alkaloid is among the most commonly consumed stimulants worldwide [32,33].

Figure 1: Chemical structure of caffeine.



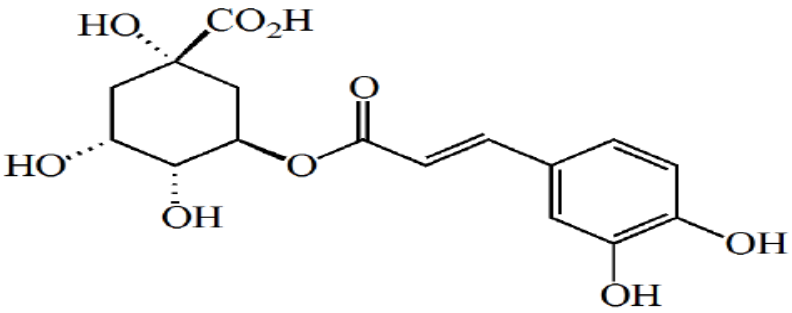


Figure 2: Chemical structure of chlorogenic acid.

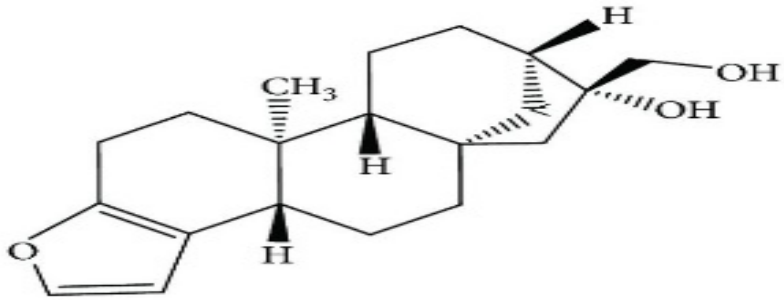


Figure 3: Chemical structure of the diterpene cafestol.

2.1 Caffeine

It contains two fused rings (Figure 1) that are related to purines [34]. Caffeine is found in many natural and processed products. Examples of these sources include green tea [35, 36], mate tea [37, 38], chocolate [39], and caffeinated beverages and energy drinks [40–41]. *C. arabica* [42] and Robusta coffee (*C. canephora* var. Robusta) [43] also contain this micronutrient. Consumption of caffeine has shown many positive effects in various human and animal experimentations. At a dose of 6mgKg−1 body mass, it was found to exhibit ergogenic effect, the ability to increase physical exercise without a concomitant increase in effort sensation, in sedentary men [44]. Its stimulatory activity was also tested, with some

promising results, in persons with Parkinson's disease, where it can be used to manage both motor and nonmotor symptoms [45]. In a mouse model, crude caffeine was found to reduce the accumulation of β-amyloid peptides, a characteristic feature in patients suffering from Parkinson's disease [46]. Investigations have revealed that crude caffeine did possess hydrophilic antioxidant activity (145 μmol Trolox equivalent (TE)/g) and lipophilic antioxidant activity (66 μmol TE/g), and its administration has led to the inhibition of cyclooxygenase-2 enzyme better than aspirin [47]. Some of the adverse effects of high doses of caffeine include decrease tonus of the lower esophageal sphincter muscle, overstimulation of central nervous system, intrauterine growth retardation, and higher risk of miscarriage [48]. Withdrawal from caffeine ingestion may present with lower mental alertness, diminished performance, and over sleepiness [49].

2.2. Chlorogenic Acid.

Chlorogenic acid (CGA) (Figure 2), which has nothing to do with chlorine, is an ester that is formed from the reaction of caffeic acid with L-quinic acid; hence the name 5-caffeoylquinic acid (5-CQA) [50, 51]. It is a polyphenolic compound that is abundant in many plants [52]. It is present in tobacco leaves [53], mulberry tree [54], and coffee beans [55]. It is found to be responsible for the astringent taste of coffee brews [56, 57]. Many positive effects have been attributed to CGA. For instance, its hypolipidemic effect has led to weight reduction in experimental mice [58, 59]. The antioxidant activities of this phytochemical were exhibited against ischemia-reperfusion injury [60] and in the protection against oxidative damage of macromolecules such as DNA, lipids, and proteins [61]. When administered to mice under scopolamine-induced amnesia, CGA has shown neuroprotective function via the inhibition of acetyl cholinesterase [62]. Different microbial entities are susceptible to CGA's antimicrobial activities. With respect to viruses, CGA has shown potential anti-H1N1 influenza virus [63]. CGA analogs that showed appreciable anti-HIV activities have been synthesized [64]. CGA is not only active against viral particles, but it has also antibacterial and antifungal functions. At minimum inhibitory concentrations (MIC) of 20–80 μg/mL, the growth of all bacterial pathogens tested was inhibited by CGA [65]. It is argued that the high resistance of immature peach fruits to the brown rot fungus, *Monilinia laxa*, is due to their high contents of CGA [66].

2.3. Diterpenes.

Diterpenes are a group of terpenoids commonly found as secondary metabolites in terrestrial and marine organisms [67]. They often occur in a C-20 backbone where isoprene units combine in different forms to give an array of diterpenes such as abietane [68], cembrane [69], guanacastepene A [70], quinonoid [71], jatropha [72], and cafestol and kahweol [73] types. These and several others may be found in coffee [74], tea [75], and *Salvia* spp. [76]. Some types have been isolated from the fungus *Trichoderma longibrachiatum* [77] and from sponge family [78]. Diterpenes have displayed several types of bioactivities via different mechanisms. A diterpene alkaloid isolated from the Caribbean sponge *Agelas citrina* has shown antifungal function [79]. Experiment with oridonin type has demonstrated its antiproliferative effect against leukemia-derived Jurkat cells [80]. Abietane type was cytotoxic to human pancreatic cancer cell line MIA PaCa-2 [81]. Antioxidant function is found in *Salvia officinalis* [82], and an isolate of the Brazilian alga *Dictyota menstrualis* has indicated anti-HIV potential of this phytochemical [83]. Antimicrobial activities are found in a recent review [84]. Some diterpenes are toxic to insects [85] and to embryos of medaka, Japanese rice fish [86]. Structure of cafestol is given in Figure 3.

2.4. Trigonelline.

Trigonelline (TRG) (Figure 4) is a nitrogenous compound, a pyridine alkaloid that is derived from the methylation of the nitrogen atom of nicotinic acid (niacin);

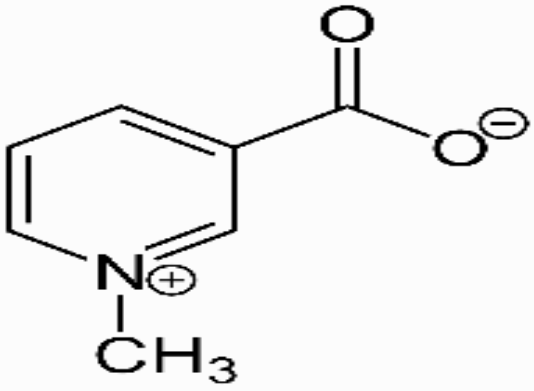


Figure 4: Chemical structure of trigonelline.

hence the name N-methyl nicotinic acid [87–88]. TRG is found in pumpkin seeds [89], mangrove legumes [90], *Moringa oleifera* tree [91], and coffee [92, 93]. It is used as roasting level discriminator in both Arabica and Robusta coffees [94]. TRG has a proven antidiabetic effect; its administration to model rats suffering from diabetes mellitus has resulted in reduced blood glucose levels in oral glucose tolerance test [95]. It has also shown beneficial effects in rats displaying peripheral neuropathy, a condition for which there is no effective drug for its treatment [96]. Its function as an inhibitor of Nrf2 gene transcription has caused pancreatic cancer cells to be more susceptible to cell death through apoptosis [97]. At an MIC of 0.8mg/mL, TRG content of *C. canephora* extracts has correlated positively with reduction in biofilm formation via bacteriostatic action on *Streptococcus mutans* [98].

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2. Tea

Tea and infusion of the leaves of the *Camellia sinensis,* is a widely consumed aromatic beverage. Consumers vary in their preferences on the

type of tea they consume, which in turn is dependent on the degree of fermentation, taste and color [99]. Tea is considered as a rejuvenator and often acts as therapeutic adjuvant for several aliments for people from all walks of life [100]. Various types of tea are popular in different regions of the world. Black tea (Bt) is consumed as beverage principally in India, Pakistan, Sri Lanka, Russia, Europe, North America, North Africa etc. and most of the processing of Bt involves intense crushing and fermentation process [101]. Green tea (Gt) is a lightly processed tea that is not fermented at all [102] and is widely consumed in China and Japan. Tea has been considered as home medicine since time immemorial. It is one of the plant products with highest total flavonoid content and these compounds are responsible for the distinctive taste and color of tea and also the health benefits associated with consumption of tea [103-118].

Polyphenols in tea are secondary metabolites of plants and are generally involved in defense against ultraviolet radiation or aggression by pathogens. Polyphenols may be classified into different groups as a function of the number of phenol rings that they contain and on the basis of structural elements that bind another [119]. The main classes of polyphenols found in tea include phenolic acids, flavonoids, and lignans. Gt and Bt differ in their chemistry, only because of their processing methods but not in leaves itself. The bioactive components in both type of tea has been summarized in table 1. Thus, which type of tea is superior in terms of health benefits, is a question of much interest. Therefore, this review was aimed at evaluating the health benefits of both types of tea with respect to their mechanism of pharmacological action.

Flavanols

Reactive oxygen species (ROS) and free radicals can cause severe damage to the normal cells of the body. These damages can be to the DNA,

proteins, and other biological macromolecules, thereby causing pathological changes in the cellular environment leading to a wide variety of chronic diseases. There are numerous studies that reveal that these diseases are mediated by oxidative stress and imbalance between prooxidant and antioxidant factors. Antioxidants play a pivotal role in preventing or slowing the progression of these conditions. In the last decade, there has been much interest in the potential health benefits of tea polyphenols as antioxidant. Epidemiological studies and associated meta-analyses strongly suggest that long term consumption of diets rich in tea polyphenols offer protection against development of cancers, cardiovascular diseases, diabetes, osteoporosis.

Table 1: Major bioactive components of tea.

Sl No	Source	Form	Compounds
1	Green tea and Black tea	Flavanol (Monomer)	Catechin, Epicatechin, Epicatechin gallate, Epigallocatechin and Epigallocatechin gallate
2	Black tea	Flavanol (Dimer)	Theafl avin,Theafl avin3gallate, Theafl avin 3 O-gallate, Theafl avin 3,3’-digallate
3	Black tea	Flavanol (Oligomer)	Thearubigin
4	Green tea and Black tea	Another flavonoid	Quercetin, Kaempferol, Myricetin
5	Green tea and Black tea	Amino acid	L theanine, Glutamine Arginine

6	Green tea and Black tea	Methyl xanthine	Caffeine
7	Green tea and Black tea	Phytoestrogens	Lignans
8	Green tea and Black tea	polysaccharides	Galactose, Arabinose, Rhamnose, Xylose, Galacturonic acid, Mannose, Ribose and Glucuronic acid
9	Green tea and Black tea	Trace minerals	Copper, Manganese, Iron and Zinc

and neurodegenerative & ocular diseases [120,121]. The phenolic groups in bioactive components of tea can donate an electron to form relatively stable phenoxyl radicals, thereby disrupting the cascade of oxidation reactions in cellular components. The most common bioactive compound found in tea are flavonoids like flavan-3-ols (flavanols or flavones), which are present in relatively large amounts in tea compared to their levels in other foods. The flavan-3-ols create the chemical signature pattern that is distinctive in each type of tea. The flavan-3-ol sub-classes are ranked by degree of polymerization [122]. The catechins are monomers (catechin, epicatechin, epicatechin gallate, epigallocatechin, and epigallocatechin gallate), the Tfs are dimers (theaflavin, Tf1, theaflavin 3-gallate, Tf2A, theaflavin 3 0- gallate, Tf2B, theaflavin 3, 3’-digallate, Tf3), and Tr are oligomers [123]. Gt is rich in monomeric catechins but lack flavanols in dimeric and oligomeric form.

Antioxidant property

Antioxidant property of Gt lies in the monomeric catechins either with or without galloyl moiety. Although Bt contains much lower concentrations of monomeric catechins than Gt, it is generally believed that dimeric or oligomeric catechins contribute greatly to antioxidant action of Bt [125]. Consumption of catechins by humans either in its monomeric form or after its epimerization results in modest transient increase in the total antioxidant capacity of plasma, measured through ferric-reducing antioxidant potential ,oxygen radical absorbance capacity or Trolox-equivalent antioxidant capacity assays [126-128].

Theaflavin (Tf)

The most important catechin oxidation products in Bt are Tf and its mono and digallanes [132].

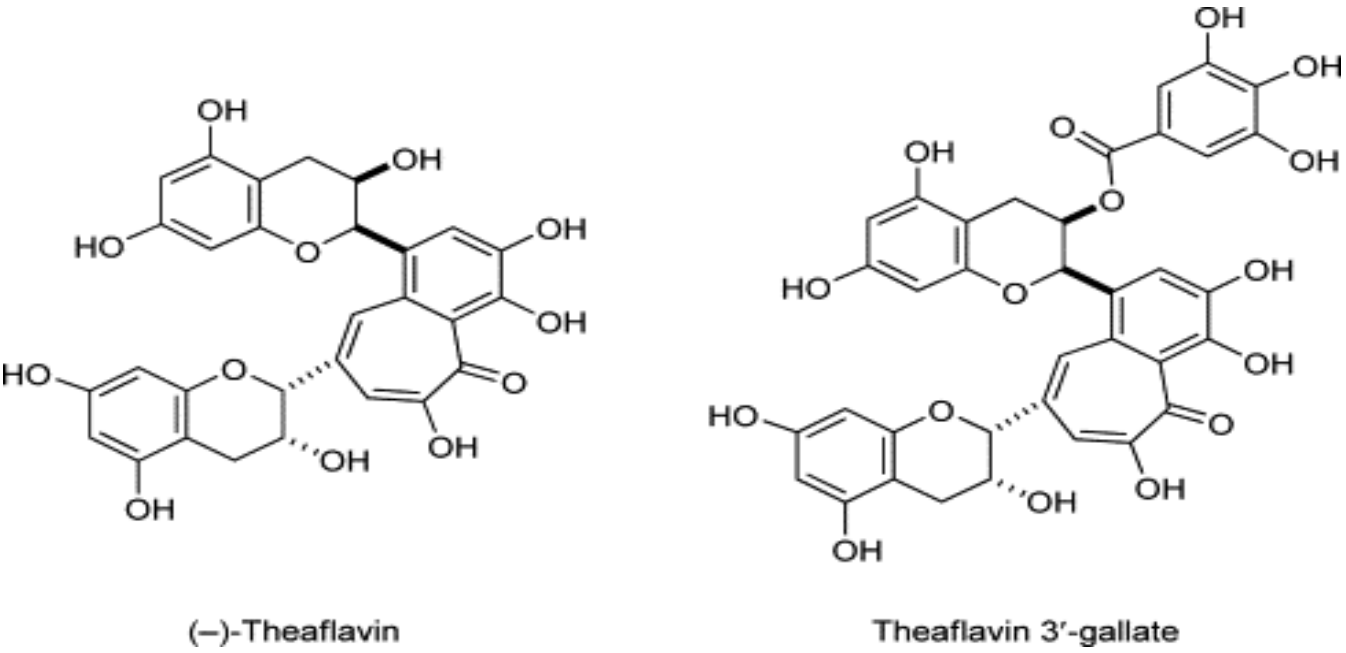

Figure 5: Chemical structure of theaflavin

Tfs possesses a characteristic benzotropolone moiety, which is produced by condensation between a catechol-type B-ring of EC and a pyrogallol-type B-ring of EGC [133]. TFs, are formed via the co-oxidation of pairs of epimerized catechins, one with a victrihydroxyphenyl moiety, and the other with an orthodihydroxyphenyl structure. Apart from epimerized catechins are four main Tf derivatives that reserve two A-rings, two C-rings from their precursors and possess a characteristic element of the fused seven-member benzotropolone ring [134]. The benzotropolone moiety of Tfs play an important role in affording antioxidant protection for the preferred oxidation site for electron donation because of the existence of resonance forms [135]. Tf radicals have a higher reduction potential than the tea catechin EGCG, Tfs have significantly higher reaction rates with

superoxide radicals than EGCG [136,137]. It has been suggested that the existence of resonance form in the benzotropolone moiety might be responsible for electron donation [138,139] and it might play an important role in affording antioxidant protection for the preferred oxidation site in the oxidant models of 2,2-diphenyl-1- picrylhydrazyl (DPPH) and hydrogen peroxide.

gallated catechins

Another important aspect of polyphenols is that the have lower gap energies between the HOMO and LUMO orbitals than those without galloyl moiety. Thus the carbon atoms of galloyl moiety has higher susceptibility toward nucleophilic attack. The antioxidant activity of Tfs were more effective than glutathione (GSH), L(+)-ascorbic (AsA), dlN- tocopherol, butylated hydroxytoluene (BHT), and butyl hydroxyanisole (BHA) in *in-vitro* peroxidation of rat liver homogenate induced by tert-butyl hydroperoxide (BHP) [140]. Both Bt and Gt have monomeric gallated catechins of the flavanol class and EGCG is the precursor of Tf3 [141] which has the most positive effect in scavenging free radicals [142].

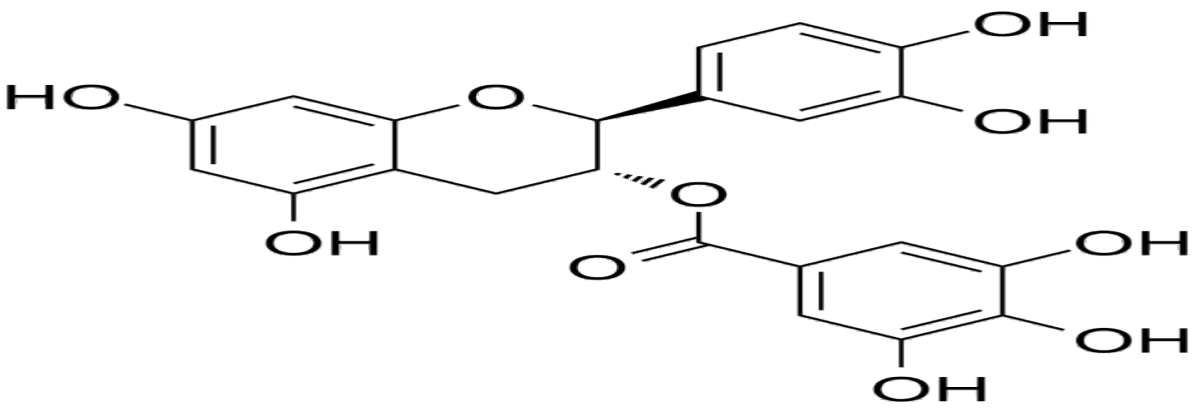

Figure 6: Chemical structure of gallated catechins

The effectiveness of Tf3 was increased by esterification with gallate [143]. The higher the number of phenyl hydroxyl groups in Tf derivatives the more it can interact with ROS and this and benzotropolone moiety

might have enhanced the scavenging of the ·O2, H2O2, and ·OH in *in vitro* models [144]. The relation of the amount of metal ions in living cells to the oxidation of lipid, the ability to chelate metal ions with Tfs are also important while evaluating its health benefits [145]. Catechins in monomeric or dimeric form can prevent the peroxidation of lipid effectively by cutting off the chain reaction in oxidation of lipid [146].

Thearubigins (Trs)

Trs are known to be heterogeneous polymers of flavan-3- ols and flavan-3-ol gallates and their bonds are presumably present at C-4, C-6, C-8, C-2′, C-5′, and C-6′ in the flavan-3-ol unit [147]. The MALDI-TOF results from a more recent study reveal that molecular weight of Trs are not over 2100 Da and these oligomers of catechins in which the 3-OH group is more and less esterified by gallic acid [148].

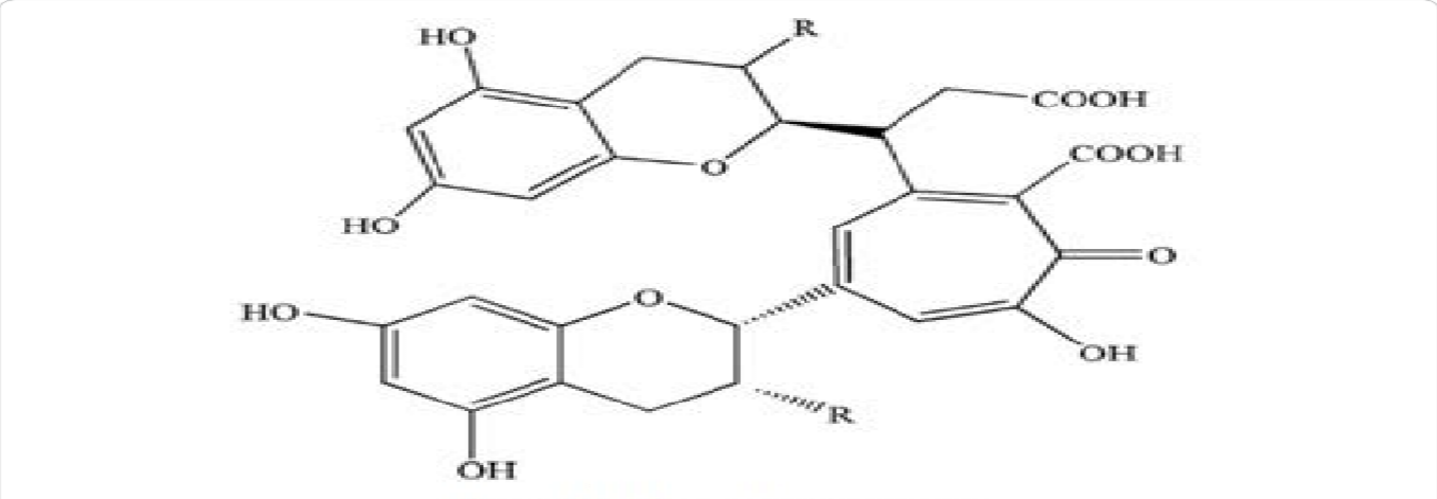

Figure 7: Chemical structure of Thearubigins

Tfs and Trs like their major precursor catechins are capable to eliminate free radicals, which is mainly due to the contribution of the residue of the active phenolic hydroxyl groups and benzotropolone groups at the Tr molecule [149]. Catechin in dimerized form, prevents DNA damage by suppressing oxidative stress and inhibiting cytochrome P450 1A1 and other oxidant enzymes under *in vitro* conditions [150]. Tf ameliorates cerebral injury through anti-inflammatory effects and

modulation of signal transducer and activator of transcription [151]. Tf targets miRNA-128-3p and leading to the activation of Nrf2 pathway thereby reducing the oxidative stress [152]. Increased expression of inducible nitric oxide synthase (iNOS) and subsequent production of large amounts of nitric oxide results in its reaction with superoxide to form peroxynitrite2 and other NO-derived oxidants capable of damaging DNA, proteins and contributes to vascular failure and end-organ damage during endotoxemia and to diseases such as asthma, short- and long-term lung disease, septic shock and other diseases [153], ulcerative colitis, and Crohn's disease [154]. Infusions prepared from Gt, Bt and individual tea polyphenols can suppress iNOS gene expression and iNOS activity in cultured macrophages [155,156]. Pharmacological suppression of iNOSdependent NO production might be helpful in the treatment and prevention of chronic diseases [157]. Tea polyphenols can also inhibit the formation of ROS by inhibiting the enzyme, xanthine oxidase which catalyzes the oxidation of both hypoxanthine and xanthine to uric acid, while reducing O2 to O·2 − and H2O2 [158]. Apart from Monomeric and dimeric catechins Quercetin found in both Bt and Gt have strong ability to sequester free radicals and bind transition metal ions [159].

Beyond antioxidant activity: as modulators of cell signaling. Despite significant advances in our understanding of the biology of tea polyphenols, they are still mistakenly regarded simply as antioxidants. The evidences suggest that their beneficial effects involve decreases in oxidative/ inflammatory stress signaling, increases in protective signaling and neuro hermetic effects leading to the expression of genes that encode antioxidant enzymes, phase-2 enzymes, neurotrophic factors, and cytoprotective proteins [160,161]. The antioxidant properties of tea also might be important during the post initiation phase of carcinogenesis [164,165]. Bt and Gt can help light cavities and prevent gum disease [166]. Tea polyphenols suppressed the growth of cavity-causing bacteria in plaque and reduced acid production levels [167]. Tea polyphenols also inhibited an enzyme produced by the bacteria, glucosyltransferase, thus preventing the formation of the matrix material by which dental plaque adheres to tooth surfaces [168].

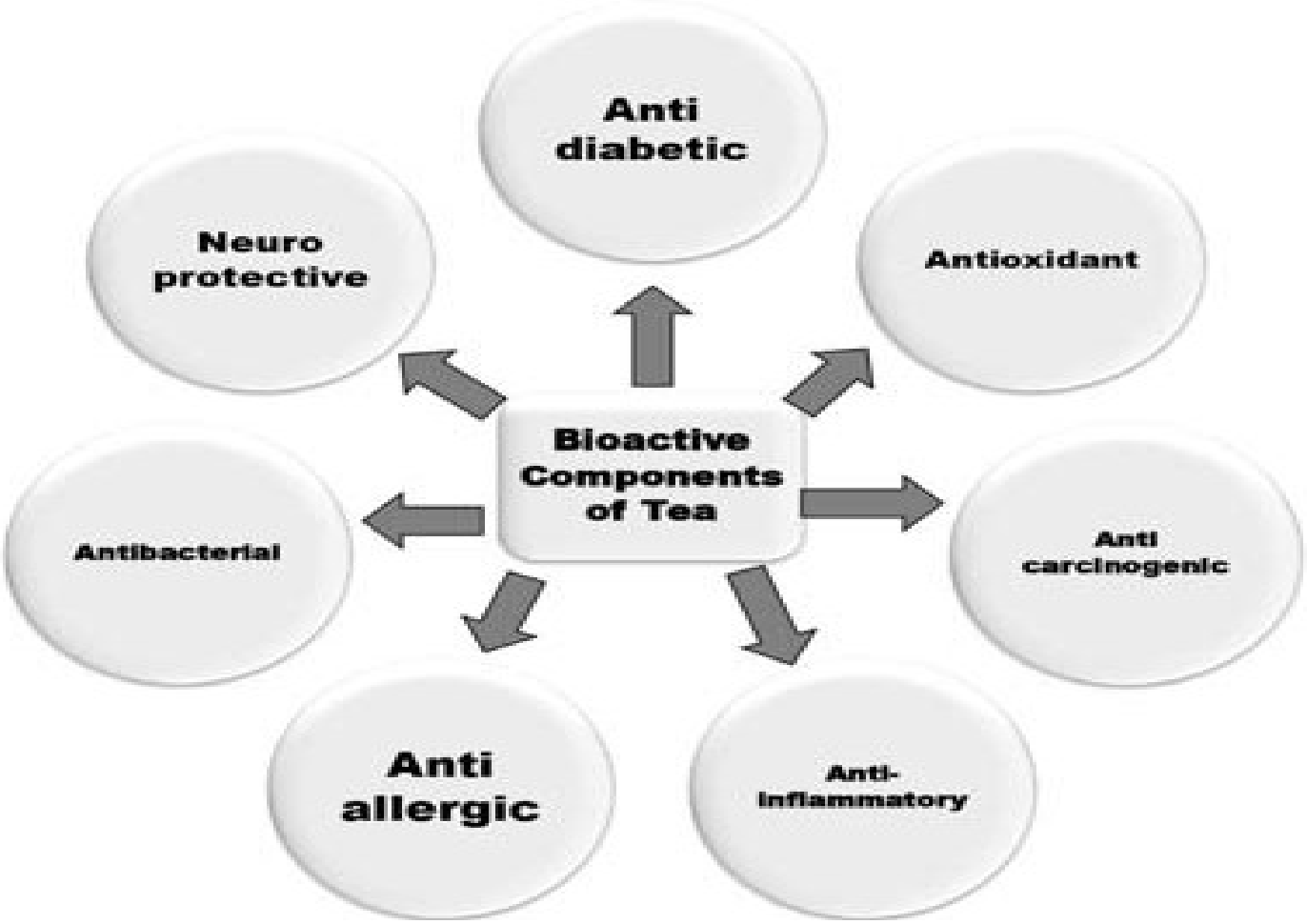

Figure 8: Health benefits of bioactive components of tea

Other important bioactive components of tea

Caffeine: Caffeine another component of Gt and Bt that may contribute to the inhibitory effect of both these beverages on tumorigenesis.

Teas containing more leaf buds tend to contain more caffeine, whereas teas made of mature leaves and stems tend to contain less caffeine. The processing also affects caffeine content [186]. Tea leaves contain 3% caffeine by weight, although this can range from 1.4% to 4.5%. The amount of caffeine present varies amongst Bt and Gt. Caffeine has numerous therapeutic effects. It targets the central nervous system, stimulates the cardiovascular and digestive system and is known for alleviating mental fatigue. The result of caffeine on the central nervous system is mood elevation, alertness, increased focus and cognitive clarity. Caffeine is also credited for aiding with metabolic functioning and is one ingredient used in

weight loss supplements. Caffeine is touted as an aid for increasing energy, which influences fat burning. Additionally, the diuretic effect of caffeine prompts frequent elimination of waste from the digestive system. Caffeine has also shown a protective effect against heart disease when used daily in moderation [187]. Recent studies have shown that topical administration of chitinase inhibitors, caffeine and dexamethasone in combination produced a remarkable reduction of inflammatory signs. Caffeine has more anti-inflammatory property than the chitinase inhibitors and significantly reduces acidic mammalian chitinase activity in tears [78].

Amino acids:

In Gt and Bt, L-theanine is one of the most important amino acid and it accounts for almost 50% of the total free amino acids found in tea. It was first discovered
in an aqueous extract of Gt, later it was reported in Bt [188]. Reports suggest that theanine is synthesized in the tea roots and then proceeded to the developing shoot tips under the
catalytic activity of a specific enzyme, L-glutamate ethylamine ligase and using the amino acid alanine as the precursor of ethyl-amide in presence of light [189]. The chemical structure of L-theanine is gamma-ethyl amide of glutamic acid. The amount of theanine present in tea is dependent upon the cultivation process, growing conditions and type of tea [190]. Reports suggest that black tea contains the highest quantity of theanine. Darjeeling black tea contains the highest quantity of theanine (250 mg/100 gms). Although caffeine can have certain negative effects on anxiety disorders, studies reveal that L-theanine neutralizes negative effects of caffeine without reducing its mind- energizing, fat-burning features [191,192]. Amino acids other than theanine found in Gt and Bt include conditionally essential amino acids glutamine and arginine. Under stress conditions, these amino acids become essential and it has to be taken as food or supplements. Gt and Bt also contains amino acids like asparagine, and serine.

Trace elements:

Tea (Bt and Gt) is rich in essential trace elements, which might play an important role in ionic homeostasis in the physiological system. Among the

minerals and essential trace elements, Ca, Na, K, Mg, and Mn are present in tea leaves at g/kg level, while Cr, Fe, Co, Ni, Cu, Zn are present at mg/kg level. Reports suggest that the presence of trace elements in green tea is lower than that of black tea. Besides essential macro- and microelements, *Camellia sinensis* strongly accumulate aluminum. Aluminum in most of its forms have no harmful effect on living organisms. However, under certain conditions aluminum might form toxic species [203]. However, these studies appear to have major limitation and may need more detailed investigations.

Bioavailability:

The worldwide popularity of tea and the absence of toxicity as a natural dietary agent, has made tea an excellent candidate for dietary prevention of chronic diseases [204]. Results from various studies show that the bioavailability of many important tea polyphenolics is low. The poor bioavailability of theaflavins, and thearubigins may be explained by Lipinski's Rule of 5, which is based on the ability of a molecule to pass through transient pores formed in the plasma membrane by the movement of the phospholipid acyl tails and also a molecule's ability to form hydrogen bonds. Many of the mechanistic studies of the tea polyphenolics have been conducted on cell lines. But it is unlikely that the concentration of polyphenol used in these experiments can be obtained in target tissues other than the skin and GI tract under *in vivo* conditions. So, correlating mechanistic data observed *in vitro* with that found *in vivo* should be done with careful consideration of the poor bioavailability of the tea polyphenols. Glucuronidation, sulfation, and methylation represent the major metabolic pathways for tea polyphenolics [205]. There are species and tissue-specific differences in tea polyphenolics glucuronidation, with humans and mice being more similar than humans and rats [206].

Materials and Methods

This study was conducted in the province of Hilla / Iraq , with the participation of 300 people of both sexes (male and female). The study included four age groups (>20, 20-40, 41-60, >60).

The questionnaire included people's preference for tea and coffee in terms of the number of cups consumed during one day, the size of the cup, and whether they prefer it with or without additives, with or without sugar, in addition to the health aspect of the people participating in this study, taking into account the presence of chronic diseases such as diabetes. and blood pressure as well as Parkinson's disease.

This study also focused on the extent to which people are affected and condemned these drinks through their effect on mental focus and their effect on their sleep and others.

The results have been converted into percentages to make it easier to explain and understand.

Results and Discussion:

Table (1) shows the number of males and the number of females participating in this study. It is clear from the results that the number of male participants was only 95, with a ratio of 31.66%, while the number of females reached 205 and the participation rate was 68.33 %. And the difference in the participation rate between males and females may be due to the interest of females in this type of studies more than that of males.

Table (1): number of males and females participating in this study.

Age Gender	<20	20-40	41-60	>60	total	Percentage %	
male	23	67	4	1	95	31.66%	
female	50	143	10	2	205	68.33%	

Table (2) shows the number of male and female participants along with the number of cups of coffee or tea that they prefer to drink during the day as follows:

(72)male and female preferred to drink 1 cup of tea ,(57)male and female preferred to drink 2cup of tea,(43)male and female preferred to drink 3cup of tea,(15male and female preferred to drink 4cup of tea,(16)male and female preferred to drink more than 4cup of tea, so the total number of male and female from participants that prefer drinking tea is 203 individuals.

(33) male and female preferred to drink 1 cup of coffee, (27) male and female preferred to drink 2 cup of coffee, (19) male and female preferred to drink 3 cup of coffee, (8) male and female preferred to drink 4 cup of coffee, (10) male and female preferred to drink more than 4cup of coffee , so the total number of participants that prefer drinking coffee is 97 individuals.

Table (2) number of male and female participants along with the number of cups of coffee or tea that they prefer to drink during the day.

Cup number Gender	**Tea 1 cup**	**Coffee 1 cup**	**Tea 2 cup**	**Coffee 2 cup**	**Tea 3cup**	**Coffee 3 cup**	**Tea 4cup**	**Coffee 4 cup**	**Tea >4 cup**	**Coffee >4 cup**	**total**
male	24	11	16	8	15	7	5	3	6	3	98
female	48	22	41	19	28	12	10	5	10	7	202
total	72	33	57	27	43	19	15	8	16	10	300

Table (3) shows the number of participants who prefer to drink coffee or tea, such as: - With or without sugar, or with excess, such as milk, chocolate, etc., or without.
Form the table the total number of participants that preferred to drink tea or coffee with sugar is (266), while, the total number of participants that preferred to drink tea or coffee without sugar is (34).
Form the table the total number of participants that preferred to drink tea or coffee with extras is (70), while, the table the total number of participants that preferred to drink tea or coffee without extras is (130).

This shows their large number of participants preferred to drink tea or coffee with sugar and large number of participants preferred to drink tea or coffee without extras.

Table (3) shows the number of participants who prefer to drink coffee or tea, such as: - With or without sugar, or with excess.

Tea or coffee With additives	With sugar	Without sugar	With extras	Without extras
Total number	266 .	34	70	130

Table (4) shows how many males and females along with how many spoonsful of sugar they prefer to add to their tea or coffee as follows: -
Form the table (33) males and (70) females they preferred to add (1) spoonful, so 100% is 34.33%.
Form the table (40) male and (80) females they preferred to add (2) spoonful, so 100% is 40%.
From the table (13) males and (27) females they preferred to add (3) spoonful, so 100% is 13.33%.
From the table (3) males and (6) females they preferred to add (4) spoonful, so 100% is 3%.
From the table (1) male and (1) female they preferred to add more than (4) spoonful, so 100% is 0.67%.
From the table (12) male and (14) female they preferred to add without sugar, so 100% is 8.78%.

Table (4): number of sugar spoon added to the tea or coffee

Sugars number Gender	**1 s**	**2 s**	**3 s**	**4 s**	**More 4 s**	**No sugar**	**total**	**Percentage %**

male	33	40	13	3	1	12	102	34%
female	70	80	27	6	1	14	198	66%
total	103	120	40	9	2	26	300	100%

S: spoon

Table (5) shows the number of females and males participating in this questionnaire. The number of males who answered the question (Do you consider yourself addicted to tea or coffee) who answered yes was 37 and the females were 79 with a percentage of 38.6% and the males who answered no were 59 and the females were 125 with a percentage of 61.4%. As for the answer to the question (Does tea affect your physical or mental performance),94 of total participating the answer was yes, with percentage of 31.3%, and206 of total participating the answer was no, with percentage of 68.7%, which means that tea or coffee It does not cause an effect. As for the answer to the question (Do you feel a headache when you leave the tea or coffee), 40 of total participating the percentage of the answer was “yes” 13.3% for tea and 59 of the total participating answer was yes with percentage of 19.6% for the coffee, while,260 of total participating the answer was “no” 86.7% for the tea and 223 of the total participating answer no with percentage 74.4% for the coffee. This means that headache is not the most important symptom of withdrawal from .coffee and tea

Table (5): the effect of tea and coffee in human body in three subject addiction, physical performance and headache

Question	Do you consider yourself addicted to tea or coffee?		Does the drink affect your mental and physical performance?		Do you feel headache when you leave tea?		Do you feel headache when you leave coffee?	
Answer gender	yes	no	yes	no	yes	no	yes	no
male	37	59	30	66	13	83	24	71
female	79	125	64	140	27	177	35	152
total	116	184	94	206	40	260	59	223
Percentage %	38.6%	61.4%	31.3%	68.7%	13.3%	86.7%	19.6%	74.4%

Table (6) shows the number of males and females participating in the answer to the side effects of coffee. The total of males and females who answered yes was 77, with percentage of 25.6%. As for the males and females who answered no, it was 223, with percentage of 74.4%. As for the question of the side effects of tea, the total number was for males and female who answered yes, is 40, with a percentage of 13.3%, and males and female who answered no, 260, with a percentage of 86.7%. This indicates that the side effects of tea are less than that of coffee. For question (Does coffee or tea cause you disturbed sleep?) the total number of male and female that answer yes was 119, with percentage 39.7%, and the total number of male and female was 181, with percentage 60.3%. that means there some effect of tea and coffee in the pattern of sleep.

Table (6): This table shows the appearance of any side effect when drinking tea or coffee, as well as sleep disturbance

Question	Have you ever drunk coffee and experienced any side effects?		Have you ever drunk tea and experienced any side effects?		Does coffee or tea cause you disturbed sleep?	
Answer gender	yes	no	yes	no	yes	no
male	24	70	12	82	37	57
female	53	153	28	178	82	124
total	77	223	40	260	119	181
	25.6%	74.4%	13.3%	86.7%	39.7%	60.3%

Table(7) shows the number of males and females participating in the questionnaire about the presence of chronic diseases or heart diseases .associated with drinking tea or coffee

Form the table only 32 of total number participating that answer yes, with percentage of 10.6%, and 268 that answer no, with percentage of 89.4%, .there have chronic disease

Form the table only 20 of total number participating that answer yes, with percentage of 6.6%, and 280 that answer no , with percentage of . 93.3%,there have heart disease

Form the table only 16 of total number participating that answer yes, with percentage of 5.3% , and 284 that answer no , with percentage of .94.7%,there have diabetes

Form the table only 24 of total number participating that answer yes, with percentage of 8% , and 276 that answer no , with percentage of 92%, there . have hypertension

Form the table only 5 of total number participating that answer yes, with percentage of 1.6% , and 295 that answer no , with percentage of 98.4%, .there have liver disease

Form the table only 1 of total number participating that answer yes, with percentage of 0.3% , and 299 that answer no , with percentage of .99.7%,there have Parkinson disease

The percentages showed that there are no many diseases compared to the .percentages of their presence

Table (7): This table shows the participants any chronic diseases such as heart disease, liver disease, diabetes, hypertension, Parkinson's

Question	Do you have any chronic diseases?		Do you have any heart disease?		Do you have diabetes?		Do you have hypertension?		Do you have any liver disease?		Do you have Parkinson disease?	
Answer gender	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no
male	10	82	6	89	5	90	8	87	2	93	0	94
female	22	186	16	191	11	194	16	189	3	202	1	204
total	32	268	20	280	16	284	24	276	5	295	1	299
Percentage%	10.6 %	89. 4%	6.6 %	93.3 %	5.3%	94.7 %	8%	92%	1.6%	98.4%	0.3 %	99. 7%

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