Tea Flowers and Health Properties

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Abstract: Tea grown in the Black Sea region of Turkey is an important product for this region and it can be stated that it is the sole and indispensable mainstay. İf we look in this manner you can hear only black tea if you ask in Rize for tea. But it is known that teas obtained from tea flowers are adding a different taste to teas, which is verified with scientific research in last years and that these type of teas getting importance in the market regarding establishing variability in the market. İn İndia and China research om developing special teas from tea flowers and make use of different taste of tea flowers are gaining speed. Turkey is a country with a tea trademark, but works are limited with tea drunken because of its taste and research about the chemical composition of tea flowers are not present. İn Turkey this is the first report on the chemical composition and content of tea flowers. The main constituents of its essential oil were determined as linalool, alfa- terpineol and geraniol. Further it was determined that tea flowers are rich in "epigallocatechin-3-gallat", an important polyphenol. This polyphenol helps loosing weight with playing important role in preventing fat production and accumulation and hereby increasing the amount of burned calorie. Besides it is supporting heart health, decreases cholosterol, lowers blood pressure, is effective against smooth and tooth diseases and strengthens tea obtained from tea flowers it becomes a important drug.

Key words: tea, seed oil, health

1. Introduction

Tea (Camellia sinensis) leaves are used to make the most widely consumed beverage, aside from water. As far we know, people have been using leaves from tea plants to make teas for a long time. However, less attention has been paid to the flowers of tea plants, which is a waste of an abundant resource. In the past 15 years, researchers have attempted to discover, identify, and evaluate functional molecules from tea flowers, and have made insightful and useful discoveries (Chen et al., 2018).

Tea flowers contain representative metabolites similar to those of tea leaves, such as catechins, flavonols, caffeine, and amino acids. The preponderant functional molecules in tea flowers include saponins, polysaccharides, aromatic compounds, spermidine derivatives, and functional proteins. Tea flower extracts are proposed to be of no toxicological concern based on evidence from the evaluation of mutagenicity, and acute and subchronic toxicity in rats. The presence of many functional metabolites in tea flowers indicates that tea flowers possess diverse biological functions, which are mostly related to catechins, polysaccharides, and saponins. Finally, the potential for, and challenges facing, future applications of tea flowers as a second resource from tea plants will be discussed.

2. Tea Flowers

The most utilized part of the tea plant is its leaves. Thus, less attention has been paid to tea flowers. There is a great deal of research on the flowers of tea plants, most of which is focused on isolation, identification, and analysis of certain families of metabolites or proteins in tea flowers. However, so far, comprehensive evaluations of these functional molecules in tea flowers compared to tea leaves is unavailable. Furthermore, the advantages and disadvantages of tea flowers as a new resource are still unclear (Chen et al., 2018).

2.1. Functional Molecules Similar to Those in Tea Leaves

Metabolites are not limited to a sole plant tissue and can be distributed among several tissues. Tea flowers contain a similar chemical composition as tea leaves. Polyphenols, such as catechins and flavonols; methylxanthines, such as caffeine; and amino acids, such as theanine, are representative metabolites in tea leaves (Wan, 2003). All of these metabolites also occur in tea flowers.

2.1.1. Catechins

Catechins are the main polyphenols in tea leaves, accounting for 70–80 % of polyphenols. The total amount of catechins is generally more than 12 % in tea leaves (dry weight) (Cabrera et al., 2006). Numerous in vitro and in vivo studies report the beneficial health-related properties of tea leaves and their catechins (Bushman, 1998; Trevisanato, 2000). The occurrence of catechins in tea flowers is of great interest. Eight monomeric catechins, catechin, epicatechin, gallocatechin, epigallocatechin (EGC), gallocatechin gallate, epigallocatechin gallate (EGCG), catechin gallate, and epicatechin gallate, have been detected in tea flowers (Lin et al., 2003; Yang et al., 2007; Yang et al., 2009; Morikawa et al., 2013). Although the contents and components of catechins vary among different regions or cultivars of tea flowers, EGCG, epicatechin gallate, and EGC have been identified as the main catechins in most tea flowers from different regions or cultivars (Lin et al., 2003; Morikawa et al., 2013). In contrast to tea leaves, tea flowers contain relatively lower contents of catechins. The catechin contents increase after budding, reaching their maximum values when the petals started to split and then decreasing to their minimum values at the full-bloom stage (Forrest and Bendall, 1969; Joshi et al., 2011). Moreover, different tea floral organs contain different components. For example, compared with other floral organs, the calyx contains the highest amount of EGCG (Forrest and Bendall, 1969).

2.1.2. Flavonols

Flavonols are important components for the color of green tea infusions and also contribute to the antioxidant capabilities of tea leaves (Wan, 2003). To date, 12 flavonols have been isolated and identified in tea (Morikawa et al., 2013; Yang et al., 2009). Like tea leaves, tea flowers contain glycosides of kaempferol, quercetin, and myricetin (Yang et al., 2009). Recently, a new flavonol glycoside, chakaflavonoside, was identified in tea flowers. The total flavonol contents accounts for 0.5–1.2% of the tea leaf dry weight (Morikawa et al., 2013).

2.1.3. Caffeine

Caffeine is a representative metabolite in tea leaves. Tea flowers contain less caffeine compared with tea leaves, accounting for ~0.3–1.1 % of the tea flower dry weight (Lİn et al., 2003). Caffeine present in tea flowers is synthesized in the tea flowers, not transported from the tea leaves (Wan and Xia, 2015). Because of the presence of catechins and the low level of caffeine in tea flowers, it has been proposed that tea flowers may be used to make an alternative tea beverage (Lin et al., 2003).

2.1.4. Amino Acids

Aromatic amino acids are important precursors of aromatic compounds in tea leaves and contribute to the aromatic quality of tea leaves (Wan, 2003). In addition, theanine, a major amino acid in tea leaves, also has many biological effects, such as a relaxation effect in humans and cooperative effects with antitumor agents against cancer (Juneja et al., 1999). In tea flowers, theanine is also the most abundant free amino acid, and the total content of free amino acids accounts for 0.8% of the tea flower dry weight [25].

3. Preponderant Functional Molecules in Tea Flowers

Tea flowers contain representative metabolites similar to those of tea leaves, such as catechins, flavonols, caffeine, and amino acids. However, the concentrations and compositions of these metabolites in tea flowers did not Show a preponderance over those in tea leaves. Following information is given about preponderant functional molecules in tea flowers.

3.1. Saponins

More than 100 saponins have been isolated and identified from different tissues of tea plants, and most categories of saponins are found in tea seeds (Wan and Xia, 2015). In contrast to tea leaves (0.04–0.07% of tea leaf dry weight) (Zhen, 2002), tea flowers contain greater levels of saponins (0.47–4.23% of tea flower dry weight) (Morikawa et al., 2012). Different regions/cultivars of tea flowers have significant effects on the contents and components of saponins. Saponins of tea flowers show multiple biological functions, including antihyperlipidemic and antihyperglycemic effects, gastromucosal protection, antiallergic effects in vitro, antiobesity effects, effects on gastric emptying in mice, and the acceleration of gastrointestinal transit (Matsuda et al. 2016).

3.2. Polysaccharides

Saccharides make up 20–25% of the total tea leaf dry weight (Wan, 2003). Tea flowers have equivalent amounts of total saccharides (20–30% of total dry weight) (Weng, 2004). Among the saccharides in teas, polysaccharides are the most representative bioactive component. In total, 13 kinds of crude and partially purified TFPS have been identified in tea flowers. In general, the molecular weights of the TFPS were greater than those of the polysaccharides of tea leaves, and the molecular weight distribution of the TFPS was wide (Wang et al., 2010). TFPS contain acid polysaccharides, which are made up of rhamnose, arabinose, galactose, glucose, xylose, mannose, galacturonic acid, and glucuronic acid.

3.3. Aromatic compounds

Tea flowers contain a similar composition of aromatic compounds as in tea leaves. Furthermore, two aromatic compounds, acetophenone and 1-phenylethanol, are highly abundant in tea flowers, while they are not highlyabundant in tea leaves (Zhou et al., 2015). Because of its mild floral odor, 1-phenylethanol is used widely as a fragrance in the cosmetic industry (Suan et al., 2004). Both aromatic compounds occur mostly in Camellia flowers. However, tea(C. sinensis) flowers contain much greater amounts of the two aromatic compounds than other Camellia flowers, such as Camellia sasanqua (Dong et al., 2012).

3.4. Spermidine Derivatives

Significantly different metabolic profiles exist between the metabolic profiles of leaves and flowers at different stages because some characteristic compounds, such as spermidine derivatives, may occur only in tea flowers (Yang et al., 2012). Further, spermidine–phenolic acid conjugates are a widely distributed group of plant secondary metabolites that accumulate in the floral parts and have diverse functions in plants, including defense responses against wounding, pathogens, and insects, floral induction, flower formation, sexual differentiation, tuberization, cell division, and cytomorphogenesis (Facchini et al., 2002).

3.5. Functional Proteins

Many functional metabolites have been isolated and identified in tea flowers. In contrast, very little attention has been paid to the functional proteins in tea flowers. The protein content accounts for 20–30% of the tea leaf dry weight and 30–50% of the tea flower dry weight (Weng, 2004). Tea flowers were found to contain proteases with hydrolytic abilities against proteins of tea infusion to produce free amino acids. Proteases from tea flowers increased the total amino acids content of tea infusion by 177 %, which was greater than the capabilities of commercial proteases (Chen et al., 2016).

4. Conclusion:

Although many functional molecules occur in tea flowers, the advantages and disadvantages of tea flower extracts and their functional molecules in future applications need to be evaluated (Chen et al. 2018). In general, low-grade tea leaves are the preferred source for the extraction of functional molecules. In the future, tea flowers could be potential resources for the extraction of functional molecules and could be used as natural value-added products, which would greatly reduce the cost of tea products. In Turkey only leaves of tea plants are used for black and green tea production. Use of tea as source for different products are not known in Turkey. After brief investigations tea plantations in Turkey can be used as source for the production of healthy products.

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