Health Effects of Purple Tea (*Camellia sinensis*)

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Abstract: Tea (*Camellia sinensis*, family Theaceae) is the most widely consumed plant-based beverage in the world. The secondary metabolites found in the tea plant and the unique combinations of these secondary metabolites are responsible for the popularity of this crop as source of consumed soft beverage. The pharmacological significance ssociated with tea's popularity is linked to its important phytochemicals which include polyphenols which are pharmacologically active and with potential to promote human health. Purple tea genotypes are differing from other tea plants due to the colour of their upper leaves. Purple tea is for example developed in Kenya and is currently cultivated. Purple tea leaves are processed by the same method used to process green tea. In addition to the usual polyphenolic compounds found in green tea, such as epigallocatechin gallate (EGCG) and epicatechin gallate (ECG), purple tea is uniqe in that it also contains anthocyanidins (malvidin, peralgonodin and cyanidin 3-*O*-galactoside) and 1,2-di-*O*-galloyl-4,6-*O*-(*S*)-hexahydroxydiphenoyl-*β*-Dglucose (GHG), a hydrolysable tannin. Purple tea also differs from other varieties of *Camellia sinensis* in its caffeine content, which is relatively lower in comparison to green and black tea. The reported biological activities of purple tea include anti-trypanosome and cerebral antioxidant activities. The characteristics of purple tea are discussed in detail in this review.

Anahtar kelimeler: Çay, mor çay, Camellia

1. Introduction

Tea (*Camellia sinensis* L.) is an important global commercial crop, andis primarily consumed as a non-alcoholic beverage made from the processed leaves. The tea beverage yields many health benefits to humans due to the extensive secondary metabolites found in tea leaves, including flavonoids, theanine, and volatile oils (Shi et al., 2011). Flavonoids, including catechins, anthocyanins, proanthocyanins, flavonols and phenolic acids, are a large groupof phenolic secondary metabolites and have potential beneficial properties for human health (Xu et al., 2015).

Anthocyanins are the largest group of water-soluble pigments in the plant kingdom and belong to the family of compounds known as flavonoids. Anthocyanins display a wide range of biological functions, such as attracting pollinators and seed dispersers and protecting plants against various biotic and abiotic stresses (Xu et al., 2015; Zhou et al., 2014).

2. *Camellia sinensis* (Purple Tea)

Purple tea (*Camellia sinensis*) belongs to the family Theaceae. It was developed by Tea Research Foundation (TRF) as a strategic approach to diversify and add value to the tea products for the domestic and international markets. It contains red and purple nthocyanins which are related to similar anthocyanin compounds found in blueberries, raspberries, purple grapes and other common foods that contribute to their haracteristic colors and health benefits (Riveropevez et al., 2008). Tea is one of the most ancient and popular therapeutic beverages consumed around the world. It can be prepared as a drink, which can have many systemic health effects or an "extract" can be made from the leaves for use as medicine. The purple tea variety has been released in response to the government's vision 2030 and Medium-Term Plan 2008-2012 (MTP), targeting new tea products diversification and value addition in order to enhance productivity of teas as well as to boost economic growth in the agricultural sector from the Tea Board of Kenya.

3. Chemical composition of Camellia sinensis

Purple tea contains bioactive compounds of which one third is polyphenols with high antioxidant potency (Kerio, 2013; Tariq, 2010) with anti-proliferation and radiation sensitizing effects important in cancer management (Lin et al.,2012). In addition, tea has alkaloids (caffeine, theophylline and theobromine), amino acids, carbohydrates, proteins, chlorophyll, fluoride, aluminium, minerals and trace elements (Cabrera, 2003). The polyphenols in purple tea includes catechins thought to be responsible for the health benefits that have traditionally been attributed to tea (Kerio, 2013; Cabrera, 2006).

4. Phenologic view of purple tea:

Purple tea contains red and purple anthocyanins – antioxidants which produce the distinctive reddish purple colors of the leaves.

5. Health Benefits of Purple Tea

Tea products made from purple leaves are highly preferred by consumers due to the health benefits. In recent years, tremendous attention has been focused on tea plant due to its pleasant flavor and bioactive substances. Tea leaves are a valuable source of secondary metabolic products, including flavonoids, alkaloids, polysaccharides and theanine (Yamamoto et al., 1997). Among these secondary metabolites, flavonoids (which comprise polyphenols, flavones, flavanonols and anthocyanins) are considered to contribute numerous pharmacological beneficial effects on human health (Hodgson and Croft, 2010; Gelejinse et al., 1999). The health benefits of tea are thought to account for tea's protective role against cardiovascular disease (Hodgson and Croft, 2010), atherosclerosis (Gelejinse et al., 1999), oxidant activity (Higdon and Frei, 2003), and cancer (Fujiki, 2005).

Fig. 1: a. Ordinary green coloured tea plants b. anthocyanin rich (purple coloured) tea plants (Kerio et al., 2012)

The color of tea leaves has been diversified through long-time natural hybridization and artificial selection. Study on purple leaves of tea plant will positively promote the diversification of tea products and the fully utilization of different tea germplasm resources. Furthermore, tea products made from purple tea leaves are highly preferred by consumers. Compared with conventional tea, the anthocyanin-rich purple tea has multiple benefic functions including strong antioxidant activity (Joshi et al., 2015), inhibition of colorectal carcinoma cell proliferation (Hsu et a., 2012), and reinforcing brain antioxidant capacity (Rashid et al., 2014).

In addition, anthocyanins can be used as commercial food colorants and have been reported to exhibit antioxidants, chemopreventive, anti-bacterial, antiangiogenic, anti-inflammatory and anti-atherosclerotic properties Zafra-Stpne et al., 2007)]. Therefore, to enhance the health potency of tea, purple-colored leaves have become one of the main qualitative attributes targeted in tea breeding programs. New tea cultivars with purple leaves have recently been developed and released in Kenya, China, Japan and India (Kerio et al., 2012; Jiang et al., 2013, Nesumi et al., 2012; Joshi et al., 2015). The contents of total phenolic compounds and total anthocyanins, including catechins were higher in purple tea leaves than in green tea ones (Kilel et al., 2013; Kerio et al., 2013). Previous study has found that malvidin is the most abundant anthocyanidin in the tea products derived from the purple colored tea clones (Kerio et al., 2012). Anthocyanins often accumulate in young leaves of plants (including tea plants), and make leaves present a purple color, then the purple color in leaves gradually turn into green as the leaves mature (Chalker-Scott, 1999).

5. Conclusion

As described in this review purple tea s an important tea genetic material displaying health characteristics. After the establishment of the first tea plantations in Turkey during 1930s-1940s with clones farmers begun to use tea seeds. Because of the cross

pollinating character of the tea plants huge genetic variation arised in Turkish tea plantations, which is an advantage for plant breeders, but an disadvantage for tea factories. During observations in tea plantations in Rize different genotypes of purple tea candidates could be observedand collected from the author team. After characterization of this material new genotypes will be added to the gene pool of tea in Rize and Turkey.

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