

A phytochemical approach for evaluation of fresh tea leaf quality in Chinese cultivars (*Camellia sinensis* var. *sinensis*) grown at tropical plain land

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ABSTRACT

Drinking tea is gaining popularity as a non-alcoholic beverage throughout the world. Apart from processing conditions, the quality of manufactured tea is dependent on fresh tea leaf quality, which is further influenced by standard plucking condition and climatic factors. Tea quality is a function of the content of leaf metabolites. Generally, tea quality varies with seasonal flushes and declines with leaf maturity. Limited information is available on the status of metabolites in fresh tea leaves during their maturity and the levels of metabolites in different seasonal flushes. Therefore, the present research aimed at studying any changes of targeted metabolite composition in fresh tea leaves with maturity which will form the scientific basis for understanding of tea quality deterioration. GC-MS and HPLC based techniques were used to analyze the metabolites from fresh tea leaves at different developmental stages. Significant variation in the levels of metabolites was observed during tea leaf maturation. The concentrations of catechin (C), epicatechin gallate (ECG), epigallocatechin gallate (EGCG) and total catechins (TC) decreased with leaf maturity, while epicatechin (EC) and epigallocatechin (EGC) showed a reverse trend. An increase of the contents of cell wall-bound phenolics with leaf maturity was noted, which was predominated by gallic acid followed by *trans-p*-coumaric acid. The relative abundance of monoterpenoids declined with leaf age, while volatile fatty acid derivatives (VFAD) and benzenoids showed an inverse trend. Activities of shikimate dehydrogenase (SKDH) and phenylalanine ammonia-lyase (PAL) also decreased with leaf age and their activities showed significant positive correlation with total catechins content. The transcript levels of flavone-3-hydroxylase and anthocyanidin synthase also showed a significant positive correlation with total catechins content. Interestingly, accumulation of total catechin showed significant negative correlation with total fatty acid derivatives, total wall-bound phenolics, chlorophyll and volatile benzenoids during leaf development. This suggests a possible alteration of carbon pool in tea leaf during maturation. It is hypothesized that the declination of flavan-3-ols biosynthesis in mature leaves might lead to a shifting of carbon flow in the direction of linked metabolic pathway related to chlorophyll, wall-bound phenolics, volatile benzenoids and fatty acids biosynthesis.

Study on the effect of different seasonal flushes (spring, summer, monsoon and autumn flushes) on metabolites accumulation indicated that the individual catechins content in tea shoots of Chinese cultivars (AV2, B157 and P312) grown at tropical plain land (Kharagpur, India) varied significantly throughout the harvested seasons in this study region. The accumulation of total catechins was found to be highest in tea leaves harvested from monsoon flush, followed by spring flush, autumn and summer flushes. The EGCG content in tea shoots harvested from monsoon flush was highest followed by autumn, spring and summer flushes. The accumulation of ECG was found to be highest in monsoon flush and lowest in autumn flush. The non-galloylated catechin such as EGC and EC content were highest in tea leaves harvested from spring flush. Highest accumulation of VFAD was observed in tea leaves harvested from autumn flush,

followed by spring, summer and monsoon flushes, whereas monoterpenoids was found to be highest in summer and spring flushes and lowest in monsoon and autumn flushes. Enhanced accumulation of volatile benzenoids was observed in spring flush, while higher sesquiterpenoids content was observed in tea shoots harvested from summer flush and least in autumn flush. Thus, with respect to accumulation of both catechins and aroma volatiles in fresh tea leaves, it can be suggested that spring flush would give a better quality finished product (black tea) as fresh tea leaves harvested from this season contained a balanced amount of aroma volatiles and catechins as compared to other seasonal flushes in this study region.

Keywords: tea, leaf maturity, metabolites, catechins, volatiles, seasonal flush