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Review

Tea: A new perspective on health benefits

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ABSTRACT

Although among the five main types of teas (white, green, oolong, black and pu-erh), black tea is the most consumed worldwide, an impressive number of scientific publications have been focused on green tea and its major compounds, flavan-3-ols ("catechins"). However, besides flavan-3-ols, there are other compounds present in tea that could be accounted as potential bioactive compounds. Therefore, the objective of the present review is to provide a new perspective on the health benefits associated with tea consumption by critically analyzing the available literature on the potential tea bioactive compounds and the current level of scientific evidence for these health benefits. Until now the exact mechanisms of action or compounds responsible for the health benefits associated with tea consumption have only been poorly investigated. It is important to consider that tea compounds will be extensively metabolized to different metabolites that will, most likely, be the compounds circulating in blood and potentially reaching the different sites of action.

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1. Introduction

Tea is the hot water infusion of the leaves of *Camellia sinensis* L. with a worldwide annual production of approximately 20% green, 2% oolong and the 78% black tea leaves (McKay & Blumberg, 2002). Other plant infusions have become very popular such as rooibos (*Aspalathus linearis*), rose hip (*Rosa* spp.) and chamomile (*Matricaria recutita* L.) however it is important to highlight that the terms "herbal teas" or tisanes are best applied to this variety of beverages.

Fig. 1 illustrates the main groups of compounds present in tea leaves and infusions beyond flavan-3-ols. The main classes of compounds are represented by flavonoids (flavan-3-ols, flavonols and proanthocyanidins), phenolic acids such as gallic acid, non-proteic amino acids such as GABA (gamma-aminobutyric acid) and L-theanine, alkaloids such as methylxanthines (e.g. caffeine) and polyamines (e.g. spermidine and spermine).

Compounds derived of flavan-3-ols such as theaflavins (dimeric forms) and thearubigins (oligomeric/polymeric forms) are formed during the oxidative processing ("fermentation") involved in the manufacturing of oolong and black teas. Thearubigins are the major compounds present in black tea however the exact chemical structure has not been fully elucidated yet.

2. Potential bioactive compounds: beyond flavan-3-ols

Secondary metabolites are present in plants for their natural defense and when consumed through the diet these compounds will be regarded in the human body as xenobiotics i.e. they will be metabolized to more water soluble compounds for further excretion. For instance, polyphenols are subjected to several phase II enzymes leading to conjugation with methyl (catechol-*O*-methyltransferases—COMT), sulfate (sulfotransferases—SULT) and glucuronyl groups (uridine-5′-diphosphate glucuronosyl-transferases—UDPGT).

Until this moment the exact mechanism of action by which the potential tea bioactive compounds exert the associated health benefits has not been elucidated yet. The few studies that attempted to investigate the mechanism of action of tea compounds evaluated only the parent compound and when considering the metabolites the concentrations used were by far higher than the physiological range found in plasma.

Therefore, the objective of the present review is to provide a new perspective on the health benefits associated with tea consumption by critically analyzing the available literature on the potential tea bioactive compounds and the current level of scientific evidence for these health benefits. Although black tea is the most consumed worldwide, the highest number of scientific publications is focused on green tea and its major compounds, flavan-3-ols. However, besides flavan-3-ols, there are other compounds present in tea that could be accounted as potential bioactive compounds and that will be discussed in this review.

2.1. Flavan-3-ols

Flavan-3-ols, commonly named catechins, account for about 30% of the dry weight of tea leaves (Balentine, Wiseman, & Bouwens, 1997). These compounds are mainly present in green tea and among them, epigallocatechin 3-gallate (EGCG) is reported as the major compound. Other types of tea such as oolong and black teas also contain these compounds although in much lower amounts (USDA, 2011).

Flavan-3-ols have been suggested to be absorbed in the small intestine and undergo extensive metabolism. Following consumption of green tea, flavan-3-ols appear to be rapidly absorbed reaching a

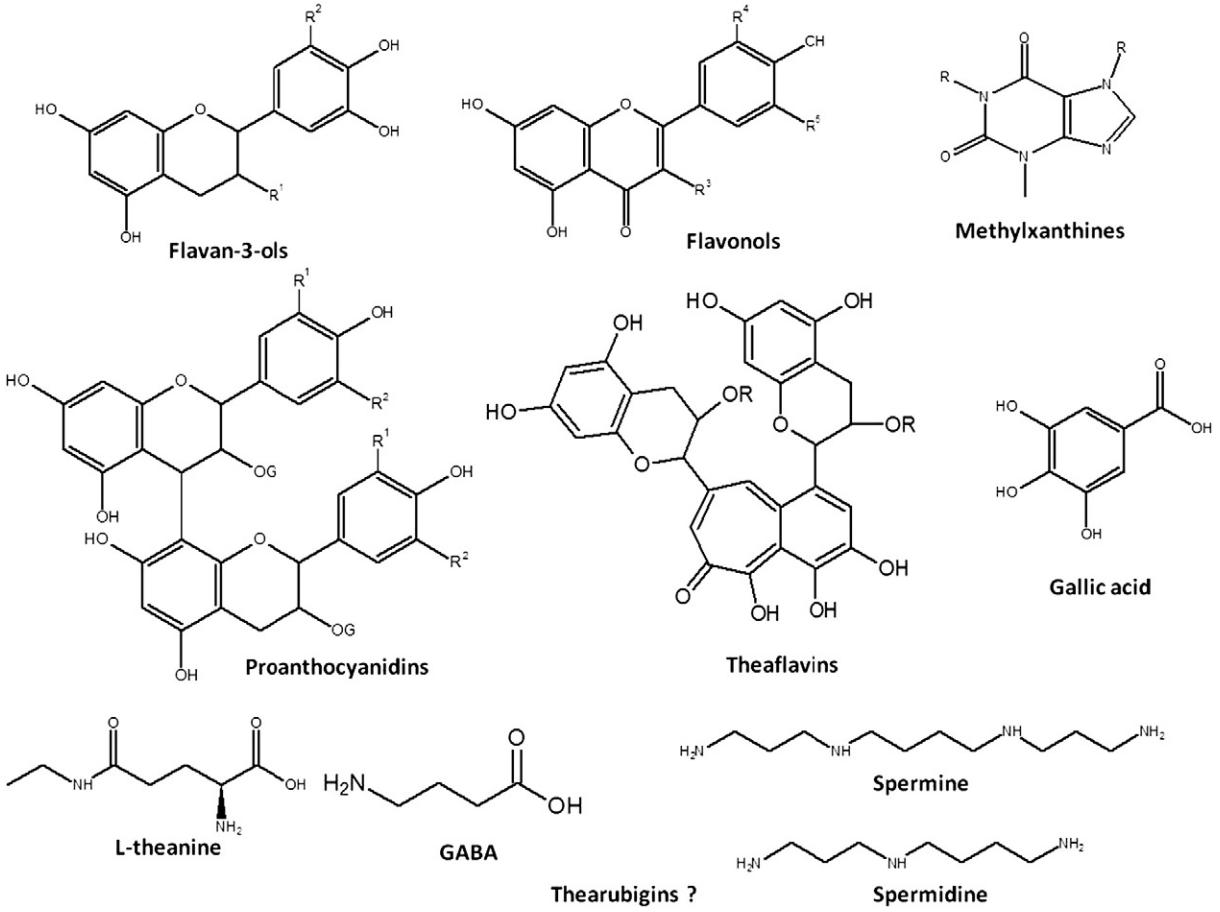

Fig. 1. Chemical structures of the main classes of compounds present in tea leaves and infusions. The chemical structure of thearubigins has not been elucidated yet although these compounds are the major ones in black tea.

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