

TOTAL FLAVONOID CONTENT OF COMMONLY CONSUMED TEAS IN INDIA

Bansode P. A*

Assistant. Professor. Department of Chemistry, Sangola College, Sangola, Dist.Solapur. (MS)
India. 413307.

Article Received on
17 Nov 2014,

Revised on 19 Dec 2014,
Accepted on 10 Jan 2015

***Correspondence for
Author**

Prakash Bansode

Assistant. Professor.
Department of
Chemistry, Sangola
College, Sangola,
Dist.Solapur. (MS) India.

ABSTRACT

The flavonoids present in the tea are known to exhibit anticarcinogenic, antimicrobial, antiviral, antiarteriosclerosis, antihypertensive, antidiabetic, anti-inflammatory and antidiuretic activities and thus they are therapeutically important class of compounds. Therefore it is necessary to find out levels of bioactive compounds in various tea samples. In the present investigation six commercial varieties including black and green tea from Indian market were analyzed for their total flavonoid content using uv-visible spectrophotometer. The total amounts of flavonoid were determined by aluminium chloride method with some modifications and the total flavonoids were expressed as mg/g of quercetin equivalents. The

results shown that all tea samples tested found to contain comparable high total flavonoids as rich sources of bioactive compounds and it justifies their use for human health benefits.

KEY WORDS: Flavonoids, Cancer, tea, Anticancer, Quercetin, human health.

INTRODUCTION

Tea is the most common, popular, non-alcoholic and widely consumed beverage next to the water across the world due to its taste, aroma and lately reported nutraceutical importance. Tea currently is the hot topic in both nutritional and therapeutic research worldwide. This is not so because tea is the most preferred drink after water, but because of the presence of crucial therapeutic compounds in tea which are more bio-stable and direct acting than those found in other plants. The activities of these compounds are so all-pervading that they are virtually broad spectrum in their actions. Besides, the natural integration of aromatic and therapeutic compounds in tea is a rather unique attribute (Bansode et. al. 2014).

The tea plant include two principal varieties as small leaved China plant (*Camellia sinensis*) and large leaved Assam plant(*C. sinensis assamica*).The tea plant species *sinensis* of Genus *Camellia* belonging to the family Theaceae (Family of flowering plants) is native to southeast Asia but currently cultivated in > 30 countries around the world. World tea production in the year 2006 was 3523 million kilograms. India is the second largest producer and consumer of tea in the world till recently (Tea Statistics 2005).It is generally accepted that next to water, tea is most consumed beverage in the world with per capita consumption of 120mL/d .Black tea represents approximately 74% of total consumed tea in the world whereas green tea accounts for approximately 24% (Katiyar et.al. 1996)

According to the different modes of processing and variable degrees of' fermentation, tea is usually of three basic types: Black tea (fully fermented), oolong tea (semi fermented) and green tea(nonfermented) but all come from the same plant. Green tea is pan fried then rolled and dried. Oolong tea is obtained by wilting the fresh leaves in the sun. Black tea is made by fermenting the slightly wilted leaves (J.A.Duke et.al.1984).In traditional days, tea was consumed to improve blood circulation, improve body resistance and to eliminate toxins (Shahidi et.al. 1992).

Currently tea research is gaining much attention of researchers and importance worldwide not due to its beverage popularity but because of presence of hundreds of crucial therapeutic compounds and antioxidants mainly flavonoids and polyflavonoids which are more biostable and directly acting compared to other medicinal plants (Chaturvedula et.al. 2011). The polyphenols and flavonoid compounds present in the tea leaves have strong antioxidant activity and broad spectrum of other important biological activities. These chemicals are synthesized in the plant body as a part of secondary plant metabolism or in response to microbial infections. These chemicals are of great therapeutic importance but present in minute quantities inside the plant tissues. This present research work is aimed at determination of total flavonoid content from commercial tea samples available in Indian market.

It is essential to have knowledge of the actual levels of bioactive ingredients in the different types and brands of teas consumed in various parts of the world in relation with human health. In the present research six commercial varieties including black and green teas were analyzed for determining their total flavonoid contents.

MATERIALS AND METHODS

Samples

A set of ten commercial tea samples consist of nine black teas (S1 = Wagh bakari tea, S2 = Sapat Parivar tea, S3 = Taj mahal tea, S4 = G.S. tea, S5 = Parichaya Golden tea, S6= loose green tea) were analyzed. All tea samples were purchased as tea bags or packaged tea and loose leaf tea from local market and specialized tea outlets.

Instrument

Readings were recorded using UV-visible spectrophotometer (Shimadzu UV 1800).

Chemicals

10% Aluminium Chloride, 1 M Potassium acetate, Quercetin standard, methanol. All the chemicals used were of analytical grade and purchased from Merck Mumbai Ltd.

METHODS

Preparation of tea extracts

The fresh tea extracts or infusions were prepared by using hot water extraction method. 5 g. of each tea sample was taken in a beaker and 100 ml. of distilled water was added. The mixture was heated on a hot plate with continuous stirring using a magnetic stirrer at 30 to 40⁰C for 30 minutes. Then the extracts were cooled and filtered through filter paper. The extracts were stored in polythene containers and kept in refrigerator for further analysis.

Detection of flavonoids

Shinoda test

Crude extract (alcoholic) was mixed with few pieces of clean and polished magnesium ribbon and concentrated hydrochloric acid was added dropwise, pink scarlet colour appeared after few minutes which indicated the presence of flavonoids.

Alkaline reagent test

Crude extract when mixed with 2 ml of 2% solution of sodium hydroxide, an intense yellow colour was formed which turned colourless on addition of few drops of dilute acid further confirmed the presence of flavonoids.

Lead acetate test

To the crude extract, few drops of lead acetate solution were added, the yellow colour appeared confirming the presence of flavonoids.

Determination of total flavonoid content in tea samples

The amount of flavonoid in the aqueous tea extracts was determined by aluminium chloride colorimetric method with some modifications. 1 ml of sample extract was mixed with 3 ml of methanol, 0.2 ml of 10 % aluminum chloride solution. At sixth minute 0.2 ml of 1 M potassium acetate was added and diluted with 5.6 ml of deionized water. The resulting mixture was incubated for 30 minutes at room temperature. The absorbance of the sample was measured at 420 nm spectrophotometrically. Quercetin was used as standard compound (1mg/ml). concentrations of 5,10,15,20 and 25 mg/100ml of quercetin were prepared in methanol. All the readings were recorded in triplicates. The results were determined from the standard calliberation curve of quercetin and total flavonoid contents were expressed as quercetin equivalents (mg/g of QE of extracted compound)

RESULTS AND DISCUSSIONS

Table 1: variation of absorbance for standard compound (Quercetin)

Concentration (mg/100 ml)	Absorbance (Mean) at λ_{\max} 420 nm.
5	0.0408
10	0.1032
15	0.1655
20	0.2231
25	0.2879

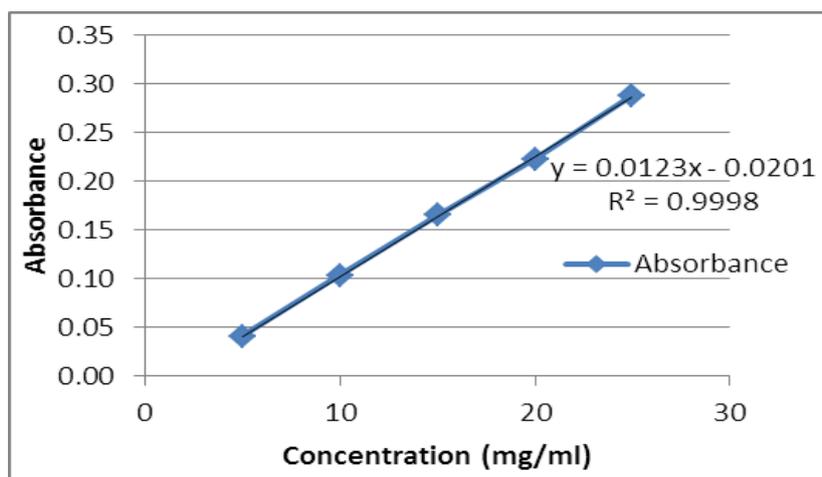


Fig. 1: Calibration Curve of Quercetin

Table 2: Total Flavonoid content in different tea samples

Sample	Total Flavonoid Content mg/g of QE
S1	37.56
S2	43.81
S3	32.16
S4	29.39
S5	48.81
S6	23.17

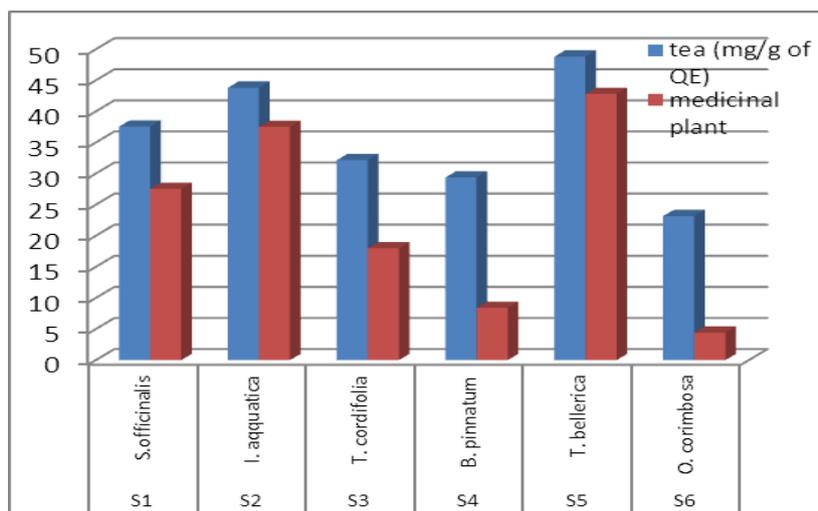


Fig 2: Total Flavonoid contents of tea samples in comparison with various Medicinal plants

The amount of total flavonoid in different tea infusions was determined with the aluminium chloride colorimetric method. Quercetin was used as standard compound and total flavonoid contents were expressed as quercetin equivalents (mg/g of QE of extracted compound). Total flavonoid varied in the range of 23.17 mg/g to 48.81 mg/g. The maximum flavonoid content was found in Parichaya Golden black tea infusion (48.81 mg/g). The results shown that all tea samples tested found to contain comparable high total flavonoids as rich sources of bioactive compounds and it justifies their use for human health benefits.

The nature and variation of tea flavonoids in the developing plant, within different parts of the plant, and their fate during processing of black and green tea have all been extensively studied as a result of their significance for tea quality (Balentine et al. 1997). However there is scarcity of literature data on individual teas commonly consumed in the various parts of the world. In a recent study on the flavonoid composition of typically consumed teas in the United Kingdom reported levels of total flavonoids in teas using reversed phase high-performance liquid chromatography (Khokar et al. 2002). Our results are in good agreement

with the findings in this report. In India many studies have been focused on determination of total flavonoid in various medicinal plants like *Salvia officinalis* (27.54mg/g) (M. Atanassova et.al.2011), *Bryophyllum pinnatum* (8.4 mg/g), *Tinospora cordifolia* (18.0 mg/g), *Ipomea aquatic* (37.5 mg/g), *Terminalia bellerica* (42.8mg/g) and *Oldenlandia corymbosa* (4.4mg/gm) (Yadav et.al.2011),.Compared to all other medicinal plants, black tea samples are found to contain higher amounts of total flavonoids.

The present study of the flavonoid composition of commonly consumed teas in India is a first attempt to identify these variables from teas in India. Many studies have focused on relationship between the consumption of tea and their potential disease prevention properties which might due to their polyflavonoid content (Fujita T 1994),(Hollman et.al. 1996).Flavonoids compounds are a class of antioxidant agents which acts as free radical scavengers(Shahidi et.al. 1992) .Many review articles have been found to report the importance of tea and it's polyflavonoids towards minimizing the risks of cancer (Dreaosti et.al.1997)(Kohlmaier et.al 1997),cardiovascular diseases(Stensvold et.al.1992),(Thelle DS1995).diabetes, renal failure(Zenuyan et.al. 1998),(Hara et.al.1995f)and also shown to exhibit antiviral, antimicrobial, anti-inflammatory effects (Diker et.al.1994),(Okubo et.al.1997).),(Katiyar et.al.1992).

CONCLUSION

Six commercial tea varieties of black and green teas were analyzed for spectrophotometric determination of total flavonoid content using aluminium chloride method and quercetin as standard. The maximum flavonoid content was found in *Parichaya Golden black tea infusion* (48.81 mg/g).Black tea infusions are rich in total flavonoids content compared to green tea infusion. The results shown that all tea samples tested found to contain comparable high total flavonoids. Compared to many medicinal plants they are rich sources of bioactive compounds and it justifies their use for human health benefits. The difference in total flavonoid levels of various teas may be attributed to agronomic conditions, leafage, processing methods, and storage during and after transport, as well as the degree of fermentation.

ACKNOWLEDGEMENT

Authors are thankful to University Grant Commission for financial assistance through 47-321/12(WRO), Dr.K.J.Ingole, Principal,Sangola College Sangola and Prof.P.S.Patil, Head, Department of Chemistry for providing necessary laboratory and library facilities.

REFERENCES

1. Bansode P.A., Shinde R.A., Kamble V.S. (2014) Spectrophotometric Determination of Total Phenolic Content of Some commonly Consumed Teas in India, *Bionano Frontier*, 2014; 7(1):78-80
2. D.A. Balentine and S.A. Wiseman. (1997) The Chemistry of tea flavonoids. *Crit. Rev. Food Sci. Nutr.* 1997; 37:693-704.
3. Dreaosti IE, Wargovich MJ, Yang CS (1997). Inhibition of Carcinogenesis by tea: the evidence from experimental studies. *Crit. Rev. Food Sci. Nutr.*, 1997; 37:761-770
4. Fujita T (1994). Osteoporosis in Japan: factors contributing to the low incidence of hip fracture. *Adv. Nutr. Res.*, 1994; 9:P89-99
5. Hara Y, Luo SJ, Wickremashinghe RL, Yamanishi T (1995f). IX. Uses and benefits of tea. *Food Rev. Int.*, 1995; 11(11): 527-542.
6. J.A. Duke and A.A. Atchley. (1984). Proximate analysis. *The Handbook of Plant Science in Agriculture*, B.R. Christie Ed. CRC Press, Boca Raton, FL,
7. Katiyar SK, Agarwal R, Wood GS, Mukhtar H (1992). Inhibition of 12-Otetradecanoylphorbol-13-acetate-caused tumor promotion in 7,12-dimethyl benz[a]anthracene -initiated SENCAR mouse skin by a polyflavonoidic fraction isolated from green tea. *Cancer Res.*, 1992; 52: 6890-6897.
8. Katiyar SK, Mukhtar H (1996). Tea in chemoprevention of cancer; epidemiologic and experimental studies. *Int. J. Oncol.* 1996; 8:221-238
9. Kohlmaier L, Weterings KGC, Steck S, Kok FJ (1997). Tea and Cancer prevention : An evaluation of epidemiologic literature. *Nutr. Cancer*, 1997; 27:1-13
10. M. Atanassova, S. Georgieva, K. Ivancheva (2011) Total phenolic and total flavonoid contents, antioxidant capacity and biological contaminants in medicinal herbs. *Journal of the University of Chemical Technology and Metallurgy*, 2011; 46(1):81-88.
11. Okubo T, Juneja R (1997). Effects of green tea polyflavonoids on human intestinal microflora. In T. Yamamoto, L. R. Juneja, D.-C. Chu, M. Kim, *Chemistry and Applications of Green Tea*. Salem: CRC Press LLC, 1997; pp. 109-122
12. P.C.H. Hollman, M.G.L. Hertog and Katan. (1996) Analysis and health effects of flavonoids. *Food Chem.* 1996; 57:43-46
13. RNS Yadav and Munin Agarwala. (2011) Phytochemical analysis of some medicinal plants, *Journal of Phytology*, 2011; 3(12):10-14.
14. S. Khokhar and S.G.M. Magnúsdóttir. Total Flavonoid, Catechin, and Caffeine Contents of Teas Commonly Consumed in the United Kingdom. *J. Agric Food Chem.* 2002; 50(3):565-70.

15. Shahidi F., Wanasundara PKJPD (1992), Flavonoidic antioxidants. Critical Reviews in Food Science and Nutrition, 1992; 32: 67-103.
16. Stensvold I, Tverdal A, Solvoll K, Foss OP (1992). Tea consumption: relationship to cholesterol, blood pressure, and coronary and total mortality. Prev. Med., 1992; 21: 546-553.
17. Stensvold I, Tverdal A, Solvoll K, Foss OP (1992). Tea consumption: relationship to cholesterol, blood pressure, and coronary and total mortality. Prev. Med., 1992; 21: 546-553.
18. Sunita Maurya & Dhananjay Singh. Quantitative Analysis of Total Flavonoidic content in Adathoda vasica Nees Extracts, International Journal of Pharm Tech Research, 2010; 2(4): 2403-2406..
19. Tea Statistics (2005), J Thomas & Company Pvt. Ltd and www.indiateaportal.com
20. Thelle DS (1995). Coffee, tea and coronary heart disease. Curr, Opin, Lipidol. 1995; 6:25-27.
21. Venkata Sai Prakash Chaturvedula and IndraPrakash. Journal of Medicinal Plants research. 2011; 5(11): 2110-2124.
22. Weisburger JH (1996). Tea antioxidants and health In: Cadenas E, Packer L, eds. Handbook of antioxidants. New York: Marcel Dekker, 1996; pp.469-486
23. Zeyuan D, Bingying T, Xiaolin L, Jinming H, Yifeng C (1998). Effect of green tea and black tea on the blood glucose, the blood triglycerides, and antioxidation in aged rats. J. Agric. Food Chem., 1998; 46: 875-878.