Development and Assessment of *In-vitro* Antioxidant Potential of Differently Flavoured Poly Herbal Green Tea Formulations

Samidha M. Pawaskar¹, Ketan Ranade²

^{1,2}Department of Biochemistry, K. J. Somaiya College of Science & Commerce, Vidyavihar, Mumbai – 400,077, Maharashtra, India.

ABSTRACT

Introduction: Green tea is a drink relished throughout the world and also has positive health benefits. Its antioxidant properties can be increased using different combination of herbs.

Aim: The aim of the research was to develop various flavoured poly herbal green tea formulations and assess their *In-vitro*-antioxidant potential.

Method: Ingredients used in the base formulation of polyherbal green tea were leaves of *Camellia sinensis* (L) Kuntz (Tea), *Cymbopogon citratus* (DC) Stapf. (Lemon grass), *Rosemarinus officinalis* (Linn.) (rosemary) and petals of *Rosa Centifolia* (Linn.) and *Hibiscus rosa-sinensis* (Linn.). Three variants of the above mentioned base formulations were made by flavouring them with leaves of *Ocimum tenuiflorum* (Linn.) (Holy Basil or Tulsi), *Mentha piperita* (Linn.) (Peppermint) and roots of *Zingiber officinale* (Rosc.) (ginger). All the three formulations were quantitatively assayed for their total antioxidant capacity, total phenolic capacity, reducing power and scavenging activities.

Results: Our study indicated that the total antioxidant capacity, total phenolic content, reducing power and hydroxyl radical scavenging activity was found to be highest in Tulsi flavoured poly herbal green tea and lowest in peppermint flavoured tea. Total flavonoid content was found to be highest in Tulsi and lowest in ginger flavoured poly herbal green tea.

Nitric oxide scavenging activity was found more in peppermint poly herbal green tea than in the other two formulations until a certain concentration (7.5 mg/ml) where the scavenging activity was almost equal for all the three formulations. Above 7.5mg/ml concentration the nitric oxide scavenging activity was observed to be more in ginger flavoured poly herbal green tea followed by tulsi and then peppermint flavoured poly herbal green tea.

Conclusion: Thus the natural poly herbal flavoured green tea formulations developed were proved to have good antioxidant potential.

Key Words: *Camellia sinensis* (L) Kuntz, *Cymbopogon citratus* (DC) Stapf., *Rosemarinus officinalis* (Linn.), *Rosa Centifolia* (Linn.), *Hibiscus rosa-sinensis* (Linn.), *Ocimum tenuiflorum* (Linn.), *Zingiber officinale* (Rosc.), *Mentha piperita* (Linn.), Total antioxidant capacity, Total phenolic content, Reducing power and scavenging activities

INTRODUCTION

Antioxidants are compounds that protect cells against the damaging effects of free radicals and reactive oxygen species. Any imbalance between the antioxidants and reactive oxygen species results in oxidative stress.¹ In normal physiological conditions also the free radicals and reactive oxygen species (ROS) are generated during metabolic processes leading to oxidative stress. However if they are not eliminated then the conditions could lead to complications.² Oxidative stress can cause oxidative damage to large biomolecules

such as proteins, DNA and lipids, resulting in an increased risk of cancer, cardiovascular disease, neural disease, Alzheimer's disease, Parkinson's disease, ulcerative disease, aging and atherosclerosis.^{2,3} Antioxidant compounds such as carotenes, phenols, phytates, etc. present in food are important for neutralizing free radicals, thus preventing ageing process and also reducing the risk from various related diseases.^{4,5}

Synthetic antioxidants could reduce the oxidative damages but could lead to carcinogenic negative effects on liver and lungs. Thus, studies of antioxidants are focused on

Corresponding Author:

Dr. Samidha M. Pawaskar, Department of Biochemistry, K. J. Somaiya College of Science & Commerce, Vidyavihar, Mumbai – 400 077, Maharashtra, India; Email: smpawaskar@somaiya.edu

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naturally occurring substances, especially on plant phytochemicals.

Thus the present study aimed to formulate a naturally flavoured poly herbal green tea, using leaves of *Camellia sinensis* (L) Kuntz(Tea), *Cymbopogon citratus* (DC) Stapf (Lemon grass), *Rosemarinus officinalis* (Linn.) (rosemary), and petals of *Rosa Centifolia*(Linn.) and *Hibiscus rosa-sinensis* (Linn.)and to assess the *in-vitro* antioxidant capacity for these formulations. Three variants of the above mentioned base formulation were made by flavouring them with leaves of *Ocimum tenuiflorum* (Linn.) (Holy Basil or Tulsi), *Mentha piperita* (Linn.) (Peppermint) and roots of *Zingiber officinale* (Rosc.) (ginger).

Tea (*Camellia sinensis* (L) Kuntz) is the most widely consumed beverage in the world⁶ and green tea is known to have several groups of polyphenols.^{1,7} Thus combinations made of such natural drinks would be useful to deliver the health benefits to the masses.

MATERIALS AND METHODS

Preparation of polyherbal flavoured green tea formulations:

Ingredients used in the preparation of base formulation of polyherbal green tea were *Camellia sinensis* (L) Kuntz-leaves, *Cymbopogon citratus* (DC) Stapfleaves, *Rosemarinus officinalis* (Linn.) leaves, *Rosa Centifolia* (Linn.) petals and *Hibiscus rosa-sinensis* (Linn.) petals. Three variants of this base formulation was made by flavouring them with the leaves of *Ocimum tenuiflorum* (Linn.) and *Mentha piperita* (Linn.)and roots of *Zingiber officinale* (Rosc.). All the ingredients were procured from local market, washed thoroughly with water and were oven dried.

Extract Preparation:

All the samples were prepared by adding hot water to tea leaves (10 mg/ml), then the mixture was kept at room temperature for 10 minutes before starting the experiments.

The assays for total antioxidant capacity, total phenol content, total flavonoid Content (flavones and flavonols), reducing power, scavenging ability for hydroxyl radicals, nitric oxide radical scavenging, were performed using known and standardized methods.⁸⁻¹⁴

Statistical Analysis

All data were expressed as the means $\pm$ SD of three independent experiments carried out in triplicate.

Results

The results of the antioxidant potential of differently flavoured polyherbal tea formulations viz., total antioxidant capacity, total

phenolic content and total flavonoid content has been represented in table 2, table 3 and table 4, respectively. Results of reducing power assay has been represented in table 5. NO scavenging assay and OH scavenging assay has been represented in table 6 and graph 1, graph 2, and graph 3 respectively.

DISCUSSION

Polyherbal flavoured green tea formulations

Dried ingredients were ground and mixed in exact quantity to make the base formulations of polyherbal green tea. Three different flavours were created. The exact composition is as shown in (Table 1). *Cymbopogon citratus* (DC) Stapf. (Lemon grass)has various phytoconstituents such as flavonoids and phenolic compounds, which consist of luteolin, isoorientin 2'-O-rhamnoside, quercetin, kaempferol and apigenin reported to have antioxidant effects.¹⁵ *Rosemarinus officinalis* (Linn.) has been known as a versatile, aromatic herb known for its powerful antioxidant activity, antibacterial and antimutagenic properties as it contains high concentration of phenolic substances obtained from the leaves of the plant. The antioxidant activity of rosemary was found mainly due to phenolic compounds responsible for rosemary antioxidant activity like phenolic di-terpenes such as carnosol, carnosic acid, rosmanol, epirosmanol and isorosmanol.¹⁶ The rose flowers and leaf extracts of *Hibiscus rosa-sinensis* (Linn.) were also found to have high antioxidant activities.¹⁷

In the present study, three variants of the above mentioned base formulation were made by flavouring them with leaves of *Ocimum tenuiflorum*(Linn.) (Holy Basil or Tulsi), *Mentha piperita* (Linn.) (Peppermint) and roots of *Zingiber officinale* (Rosc.) (ginger).

Total antioxidant activity:

The total antioxidant activities of all the three flavoured natural polyherbal green tea formulations were examined and expressed as gallic acid equivalents (Table 2)

The total antioxidant capacity of *Ocimum tenuiflorum*(Linn.), *Zingiber officinale* (Rosc.)and *Mentha piperita* (Linn.)flavoured poly herbal green tea in our study is reported in Table 2. We found that the total antioxidant capacity of *Ocimum tenuiflorum*(Linn.) flavoured poly herbal green tea was 30% more than *Zingiber officinale* (Rosc.)flavoured poly herbal green tea.(Table 2). Pandey et al, 2014 reported that *Ocimum tenuiflorum*of family Labiateae is a good source of linalool, eugenol, methyl charicol and cineole. Presence of eugenol contributes to its antioxidant property and is also thought to be responsible for inhibition of lipid peroxidation.⁶This could be the reason for very high antioxidant activity of *Ocimum tenuiflorum*(Linn.) found inthe present study.

Total Phenolic Content and Flavanoid content:

Total phenolic content of all the three flavoured natural poly herbal green tea formulations was examined and expressed gallic acid equivalents. Standard graph of gallic acid for total phenolic content is represented in Table 3 and Total flavonoid content was examined and expressed as mg of Quercetin equivalents (QE)/g of the plant material. (standard graph of quercetin for total flavanoid content is represented in (Table 4).

The total phenolic content of *Ocimum tenuiflorum* (Linn.), *Zingiber officinale* (Rosc.) and *Mentha piperita* (Linn.) flavoured poly herbal green tea was found to be 482.4 ± 22 , 360.0 ± 24 and 280.0 ± 18 mgs of gallic acid equivalents (GAE)/g of the plant material respectively. It was found that phenolic content of *Ocimum tenuiflorum* (Linn.) flavoured tea was 34% higher than the *Zingiber officinale* (Rosc.) flavoured poly herbal green tea. Our results are nearly similar to the results of Somia Lessed *et al* who reported total phenolic content of 394.66 ± 22.67 mgs of gallic acid equivalents (GAE)/g of the plant material.¹⁸ Kaurinovic B *et al*. also reported significant amount of total phenolic content in the water extracts of *Ocimum basilicum*.¹⁹

The total flavonoid content of *Ocimum tenuiflorum* (Linn.), *Zingiber officinale* (Rosc.) and *Mentha piperita* (Linn.) flavoured poly herbal green tea was found to be 32.60 ± 1.60 , 20.69 ± 0.60 and 31.661 ± 0.98 mgs of Quercetin equivalents (QE)/g of the plant material. One such study reported the total flavonoid content of 5.04 ± 0.59 mgs of Quercetin equivalents (QE)/g of the plant material.¹⁸ However the medium used for the extraction by them was chloroform, whereas we had used plain water for the said extraction. McKay *et al*. reported that the *Mentha piperita* (Linn.) leaves contain the phenolic constituents including rosmarinic acid and several flavonoids, primarily eriocitrin, luteolin and hesperidin and show a strong antioxidant potential.²⁰

Reducing Power Assay:

The results in this study showed that the reducing power was observed to be increasing with the concentration of the extract (Figure 1) (Table 5). The reducing capacity was found to be increasing in the order *Mentha piperita* (Linn.) flavoured poly herbal green tea < *Zingiber officinale* (Rosc.) flavoured poly herbal green tea < *Ocimum tenuiflorum* (Linn.) flavoured poly herbal green tea < Ascorbic oxide standard. Significant association of the Reducing power and the antioxidant activity has also been documented.²¹ Compounds with reducing power indicate that the electron donating property can reduce the oxidized intermediates of lipid peroxidation processes and thus they can act as primary and secondary antioxidants.²²

Nitric oxide radical scavenging (NO) assay:

Nitric oxide scavenging activity was found to be more in *Mentha piperita* (Linn.) flavoured poly herbal green tea than

in the other two formulations until a certain concentration (30 mg/ml) where the scavenging activity was almost equal for all the three formulations (Figure 2) (Table 6). Above 30 mg/ml concentration the nitric oxide scavenging activity was observed to be more in *Zingiber officinale* (Rosc.) flavoured poly herbal green tea followed by *Ocimum tenuiflorum* (Linn.) flavoured poly herbal green tea and then the *Mentha piperita* (Linn.) flavoured poly herbal green tea. The nitric oxide scavenging activity of the standard ascorbic oxide was found to be more compared to all three formulations, at any given concentrations.

Hydroxyl radical scavenging (HO) assay:

Hydroxyl radical is one of the potent reactive oxygen species present in the biological system. These ions damage cells by interacting with the phospholipids of the cell membrane.²³ Hydroxyl radical scavenging activity was observed to be decreasing in the order standard ascorbic acid > *Ocimum tenuiflorum* (Linn.) flavoured poly herbal green tea > *Zingiber officinale* (Rosc.) flavoured poly herbal green tea > *Mentha piperita* (Linn.) flavoured poly herbal green tea. It increased as the concentration of standard and the extracts increased (Figure 3) (Table 6).

CONCLUSION

A natural polyherbal green tea formulations in three flavours were developed. All the three flavours were studied for their total antioxidant capacity, total phenolic content and scavenging activities. All the three flavours of natural polyherbal green tea formulation developed were proved to have good antioxidant potential and can have potential application as therapeutics.

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REFERENCES

- Chacko SM, Thambi PT, Kuttan R, Nishigaki I. Beneficial effects of green tea: A Literature review. *Chinese Medicine*.2010;5:13.
- Chanda S and Dave R. December *In-vitro* models for antioxidant activity evaluation and some medicinal plants possessing antioxidant properties: An overview, *Afr. J. Microbiol Res*.2009;13:981-996
- Ock Kyoung C, Dae-Ok K, Nancy S, David S, Jae Taek H and Chang Yong L. Daily consumption of phenolics and total antioxidant capacity from fruit and vegetables in the American diet, *J Sci Food Agric*.2005;85:1715–1724
- Raghavendra M, Araveeti Madhusudhana R, Pulala Raghuvier Y, Sudharshan Raju A, Siva Kumar L. Comparative studies on the *in vitro* antioxidant properties of methanolic leafy extracts from six edible leafy vegetables of India. *Asian J Pharm Clin Res*. 2013;6(3):96-99.
- Sanjeevkumar CB., Londonkar R, Umesh MK and Asha NK. Tukapp. Screening of *In-vitro* Antioxidant Activity of Chloroform Extracts of *Bryonopsis laciniosa* Fruits, *Int.J.Curr.Microbiol.App.Sci*.2016; 5(3): 590-597.
- Abhay Kumar P, Pooja S, Nijendra Nath T. Chemistry and bioactivities of essential oils of some *Ocimum* species: an overview, *Asian Pac J Trop Biomed*.2014;4(9):682-694.
- Ahmad M, Baba WN, Shah U, Gani A, Gani A. Nutraceuical Properties of the Green Tea Polyphenols, *J Food Process Technol*.2014;5:390.
- Samidha M P and Sasangan KC. Preliminary phytochemical and invitro- antioxidant and analysis of *Moringa oleifera* Lam. leaf extract, *International Journal of Recent Advances in Multidisciplinary Research*.2017;4(8):2733-2740.
- Prieto P., Pineda M. and Aguilar M. Spectrophotometric quantitation of antioxidant capacity through the formation of a phosphomolybdenum complex: specific application to the determination of vitamin E, *Anal. Biochem*.1999;269:337-341.
- McDonald S, Prenzler PD, Antolovich M, Robards K. Phenolic content and antioxidant activity of olive extracts, *Food Chem*.2001:73-84.
- Athukorala Y, Kim KN, Jeon YJ. Antiproliferative and antioxidant properties of an enzymatic hydrolysate from brown alga *Ecklonia cava*, *Food Chem. Toxicol*. 2006;44: 1065-74.
- Oyaizu M. Studies on products of browning reactions: antioxidative activities of products of browning reaction prepared from glucosamine, *Jap. J. Nutr*.1986;44: 307-315.
- Green LC, Wagner DA, Glogowski J, Skipper PL, Wishnok JS, Tannenbaum SR. Analysis of nitrate, nitrite and 15N nitrate in biological fluids, *Anal. Biochem*.1982;126:131-138.
- Jayaprakasha GK, Jaganmohan Rao L, Sakariah KK. Antioxidant activities of flavidin in different in vitro model systems, *Bioorg. Med. Chem*.2004;12:5141-5146.
- Shah G, Shri R, Panchal V, Sharma N, Singh B, Mann A S. Scientific basis for the therapeutic use of *Cymbopogon citratus*, stapf (Lemon grass). *J Adv Pharm Technol Res*.2011;2(1):3-8
- Gad A.S. and Sayd A.F. Antioxidant Properties of Rosemary and Its Potential Uses as Natural Antioxidant in Dairy Products—A Review, *Food and Nutrition Sciences*.2015;6:179-193.
- Deepa G, Ayesha S, Aditya M, Thankamani M. *In-vitro* antioxidant activity and phytochemical analysis in extracts of *Hibiscus rosa-sinensis* stem and leaves, *Free Radicals and Antioxidants*.2012;2(3):41-46.
- Somia L, Claudia D, Radja D. Protective effect of green tea (*Camellia sinensis* (L) Kuntze) against prostate cancer: From In vitro data to Algerian patients, *Evid*.2017; Article ID 1691568
- Kaurinovic B, Popovic M, Vlaisavljevic S. Antioxidant capacity of *Ocimum basilicum* L and *Origanum vulgare* L. Extracts. *Molecules*.2011;16(9),7401-7414.
- McKay D L. and Blumberg J. B. A review of the bioactivity and potential health benefits of peppermint tea (*Mentha piperita* L.), *Phytother. Res*.2006;20:619–633.
- Oktay M, Gulcin I, Kufrevioglu OI. Determination of in vitro antioxidant activity of fennel (*Foeniculum vulgare*) seed extracts, *Leb.-Wissen. Technol*.2003;36:263-271.
- Yen GC, Chen HY. Antioxidant activity of various tea extracts in relation to their Antimutagenicity. *J. Agric. Food Chem*.1995;43:27-32.
- Halliwell B, Gutteridge JMC. Formation of thiobarbituric acid reactive substances from deoxyribose in the presence of iron salts: the role of superoxide and hydroxyl radicals, *FEBS Lett*.1981;128:347-352.

Table 1: Natural poly herbal green tea formula and three flavouring agents.

Ingredients	Amount (g)
Base Formulation	
<i>Camellia sinensis</i> (L) Kuntz(leaves)	50g
<i>Cymbopogon citratus</i> (DC) Stapf. (leaves)	10g
<i>Rosemarinus officinalis</i> (Linn.) (leaves)	10g
<i>Rosa Centifolia</i> (Linn.)(petals)	5g
<i>Hibiscus rosa-sinensis</i> (Linn.) (petals)	5g
Flavouring agents	
<i>Ocimum tenuiflorum</i> (Linn.) (leaves)	20g
<i>Zingiber officinale</i> (Rosc.) (roots)	20g
<i>Mentha piperita</i> (Linn.) (leaves)	20g

Table 2: Total antioxidant activity(TAA) of polyherbal tea expressed as mg of Gallic acid equivalents (GAE)/G of the plant material (flavours) of (*Ocimum tenuiflorum*(Linn.), *Zingiber officinale*(Rosc.) and *Mentha piperita*(Linn.))

Sr. No.	Plant sample(flavours)	Total Antioxidant activity (TAA) expressed as mg of Gallic acid equivalents (GAE)/g of the plant material.
1	<i>Ocimum tenuiflorum</i> (Linn.)	304.20 ± 10.08
2	<i>Zingiber officinale</i> (Rosc.)	234.0 ± 08.10
3	<i>Mentha piperita</i> (Linn.)	182.0 ± 08.00

*All values are expressed as mean ± SD for three determinations

Table 3: Total phenolic content(TPC) of polyherbal tea expressed as mg of Gallic acid equivalents (GAE)/G of the plant material (flavours) of (*Ocimum tenuiflorum*(Linn.), *Zingiber officinale* (Rosc.) and *Mentha piperita* (Linn.))

Sr. No.	Plant sample (flavours)	Total Phenolic Content (TPC) expressed as mg of Gallic acid equivalents (GAE)/g of the plant material.
1	<i>Ocimum tenuiflorum</i> (Linn.)	482.4 ± 22
2	<i>Zingiber officinale</i> (Rosc.)	360.0 ± 24
3	<i>Mentha piperita</i> (Linn.)	280.0 ± 18

*All values are expressed as mean ± SD for three determinations

Table 4: Total Flavonoid content (Flavones and Flavanols) – (TFC) of polyherbal tea expressed as mg of Quercetin equivalents (QE)/G of the plant material (flavours) of (*Ocimum tenuiflorum*(Linn.), *Zingiber officinale* (Rosc.) and *Mentha piperita* (Linn.))

Sr. No.	Plant sample(flavours)	Total Flavonoid Content (Flavones and Flavonols) - (TFC)- expressed as mg of Quercetin equivalents (QE)/g of the plant material.
1	<i>Ocimum tenuiflorum</i> (Linn.)	32.60 ± 1.60
2	<i>Zingiber officinale</i> (Rosc.)	20.69 ± 0.60
3	<i>Mentha piperita</i> (Linn.)	31.661 ± 0.98

*All values are expressed as mean ± SD for three determinations

Table 5: Results of Reducing power assay showing concentrations of the drug i.e. Standard / Plant Extract(flavours)of (*Ocimum tenuiflorum*(Linn.), *Zingiber officinale* (Rosc.) and *Mentha piperita* (Linn.)) (in mg/ml) and the absorbance (taken at 700 nm).

Tube no.	Concentration of Standard / Plant Extract (mg/ml)	Absorbance of Standard at 700 nm	Absorbance of <i>Ocimum tenuiflorum</i> (Linn.)at 700 nm	Absorbance of <i>Zingiber officinale</i> (Rosc.) 700 nm	Absorbance of <i>Mentha piperita</i> (Linn.) 700 nm
1.	2	0.28 ± 0.03	0.26 ± 0.02	0.22 ± 0.03	0.24 ± 0.04
2.	4	0.44 ± 0.07	0.40 ± 0.06	0.35 ± 0.02	0.37 ± 0.03
3.	6	0.53 ± 0.06	0.48 ± 0.05	0.44 ± 0.06	0.45 ± 0.02
4.	8	0.66 ± 0.08	0.57 ± 0.05	0.52 ± 0.06	0.51 ± 0.02
5.	10	0.74 ± 0.04	0.68 ± 0.03	0.66 ± 0.02	0.65 ± 0.05

*All values are expressed as mean ± SD for three determinations

Table 6: Results showing concentrations of the drug i.e. Standard / Plant Extract(flavours) of(*Ocimum tenuiflorum*(Linn.), *Zingiber officinale* (Rosc.) and *Mentha piperita* (Linn.)) (in mg/ml) and the NO and OH scavenged (% activity) shown by the drug ie. Standard Ascorbic acid / Plant extracts.

Tube No.	Concentration of Plant extract (mg/ml)	NO scavenged (% activity) Standard Ascorbic acid	NO scavenged (% activity) <i>Ocimum tenuiflorum</i> (Linn.)	NO scavenged (% activity) <i>Zingiber officinale</i> (Rosc.)	NO scavenged (% activity) <i>Mentha piperita</i> (Linn.)
1	10	50.83 + 0.10	38.17+ 0.20	45.00+ 0.21	49.17+ 0.19
2	30	65.83 + 0.13	55.00+ 0.17	56.08+ 0.16	62.92+ 0.15
3	50	75.42 + 0.12	68.33+ 0.21	75.33+ 0.26	71.50+ 0.22
4	70	81.25 + 0.07	76.08+ 0.14	78.92+ 0.14	76.83+ 0.11
5	90	93.33 + 0.06	87.08+ 0.06	91.25+ 0.06	84.75+ 0.10
Tube No.	Concentration of Plant extract (mg/ml)	OH scavenged (% activity) Standard Ascorbic acid	OH scavenged (% activity) <i>Ocimum tenuiflorum</i> (Linn.)	OH scavenged (% activity) <i>Zingiber officinale</i> (Rosc.)	OH scavenged (% activity) <i>Mentha piperita</i> (Linn.)
1	10	39.05 + 0.10	32.38+ 0.19	26.67+ 0.15	23.81+ 0.12
2	30	65.71 + 0.09	50.48+ 0.11	43.81+ 0.07	40.00+ 0.13
3	50	75.24 + 0.18	56.19+ 0.13	50.48+ 0.16	44.76+ 0.17
4	70	80.00 + 0.20	65.71+ 0.28	58.10+ 0.24	52.38+ 0.23
5	90	87.62 + 0.07	66.67+ 0.15	60.00+ 0.11	58.95+ 0.14

*All values are expressed as mean $\pm$ SD for three determinations

Figure 1: Results of Reducing power assay, showing graph of the concentrations of the drug i.e. Standard/Plant Extract (flavours) of (*Ocimum tenuiflorum*(Linn.), *Zingiber officinale* (Rosc.) and *Mentha piperita* (Linn.))(mg/ml) against the absorbance (taken at 700 nm).

Figure 2: Graph of concentrations of the drug i.e. Standard/Plant Extract (flavours) of (*Ocimum tenuiflorum*(Linn.), *Zingiber officinale* (Rosc.) and *Mentha piperita* (Linn.)) in mg/ml and the NO scavenged (% activity) shown by the drug i.e. Standard/Plant extract.

Figure 3: Graph of concentrations of the drug ie. Standard/Plant Extract (flavours) of (*Ocimum tenuiflorum*(Linn.), *Zingiber officinale* (Rosc.) and *Mentha piperita* (Linn.)) (mg/ml) and the OH scavenged (% activity) shown by the drug i.e. Standard/Plant Extract