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A COMPARATIVE STUDY OF BLACK TEA AND INSTANT TEA TO DEVELOP AN INSTANT TEA TABLET WITH RETAINED HEALTH PROMOTING PROPERTIES

By

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When I am stepping on my way,
while finding the success.....

My mother... .. My husband.....

Your love, dedication and devotion towards my needs
kept me motivated and inspired even in darkest days.

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I am look forward to the day.....
where we can rejoice together in heaven.

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TABLE OF CONTENTS

Page

Table of contents i

List of tables vii

List of figures x

Abbreviations xiii

Acknowledgements xv

Abstract xvii

1. INTRODUCTION AND LITERATURE REVIEW

1.1 General introduction 1

1.2 Introduction to black tea 2

1.2.1 The tea plant 2

1.2.2 Black tea 3

1.2.3 Health benefits of tea 6

1.2.4 Chemistry of black tea 9

1.3 Chemical changes during fermentation to produce black tea 11

1.3.1 Theaflavins 12

1.3.2 Thearubigins 14

1.4 Instant black tea 14

1.4.1 Fate of polyphenols during instant tea manufacture 18

1.5 Tablets 19

1.5.1 Excipients 19

1.5.1.1 Lactose 20

1.5.1.2 Mannitol 20

1.5.1.3 Microcrystalline cellulose 21

1.5.1.4 Sodium starch glycolate 21

1.5.1.5 Magnesium stearate 22

1.5.1.6 Fumed silica- Aerosil 22

1.5.2 Preparation of formulations 22

1.5.2.1 Moisture absorptivity 23

1.5.2.2 Angle of repose 23

1.5.2.3 Compressibility index (CI) 24

1.5.2.4 Moisture content 26

1.5.3 The tabletting process 26

1.5.4 Evaluation of tablets 27

1.5.4.1 Hardness 27

1.5.4.2 Thickness 27

1.5.4.3 Uniformity of weight 28

1.5.4.4 Disintegration time 28

1.5.4.5 Friability 29

1.5.5 Stability studies 30

1.5.5.1 Real time stability test 30

1.5.5.2 Accelerated stability 30

1.5.6 Microbiological quality 31

1.6 Scope of the thesis 31

2. MATERIALS AND METHODS

2.1 Materials 32

2.1.1 Solvents 32

2.1.2 Reagents and standards 32

2.1.3 Instant tea powder 32

2.2 Methods 33

2.2.1 Equipment 33

2.2.2 Sensory evaluation 33

2.2.3 Studies on polyphenols of brewed and instant tea 35

2.2.3.1 Total phenols 35

2.2.3.2 Total flavonoids 36

2.2.3.3 Theaflavins and thearubigins 38

2.2.4 HPLC analysis of brewed and instant tea and their theaflavins fractions 40

2.2.5 Chromatographic analysis of brewed and instant tea and their thearubigins fractions on sephadex LH – 20 41

2.2.6 Determination of antioxidant potential of brewed and instant tea 43

2.2.6.1 DPPH Free radical scavenging activity 43

2.2.6.2 ABTS radical cation scavenging activity 45

2.2.6.3 Ferric reducing ability power (FRAP) assay 48

2.2.7 Isolation of caffeine from black tea leaves and quantification of caffeine in brewed and instant tea 51

2.2.8 Studies on the oxidation of phenols in tea brew 53

2.2.8.1 Oxidation of phenols in tea at different pH values 54

2.2.8.2 Oxidation of phenols in tea at different temperatures at pH = 9.6 56

2.2.8.3 Oxidation of phenols in tea at different hydrogen peroxide concentrations 56

2.2.9 *In vivo* antioxidant assay 58

2.2.9.1 Assay 60

2.2.10 Tabletting 62

2.2.10.1 Preparation of different formulations 62

2.2.10.2 Determination physical properties of formulations 64

2.2.10.3 Preparation of tablets 67

2.2.10.4 Determination physical properties of tablets 68

2.2.10.5 Moisture absorptivity 69

2.2.10.6 Stability studies 69

2.2.10. 7 Microbiological analysis 70

3. RESULTS AND DISCUSSION

3.1 Introduction 72

3.2 Sensory evaluation of brewed and instant tea 72

3.3 Studies on polyphenols of brewed and instant tea 76

3.3.1 Total phenols and total flavonoids 76

3.3.1.1 Total phenols 76

3.3.1.2 Total flavonoids 77

3.3.2 Theaflavins and thearubigins 78

3.3.3 HPLC analysis of brewed and instant tea and their theaflavins fractions 80

3.3.4 Chromatographic analysis on Sephadex LH-20 84

3.4 Determination of antioxidant potential of brewed and instant tea 87

3.4.1 DPPH free radical scavenging activity 87

3.4.2 ABTS radical cation scavenging activity 88

3.4.3 Ferric Reducing Ability Power (FRAP) assay 89

3.5 Isolation of caffeine from black tea leaves and quantification of caffeine in brewed and instant tea 90

3.6 Studies on the oxidation of phenols in tea brew 91

3.6.1 Effect of pH 92

3.6.2 Effect of hydrogen peroxide concentration 93

3.6.3 Effect of temperature 95

3.7 *In vivo* antioxidant assay 96

3.7.1 TBARS assay for serum and organs 96

3.8 Tabletting 98

3.8.1 Preparation of formulations 98

3.8.2 Preparation of tablets 101

3.8.3 Physical properties of tea tablets for different formulations 102

3.8.4 Stability tests 102

3.8.5 Microbiological analysis 105

4. CONCLUSION 107

5. REFERENCES 108

6. APPENDICES 118

Appendix 1 - List of Publications 118

Appendix 2 - Evaluation Card for Sensory Analysis of Tea brews 119

Appendix 3 - Sample format of sensory evaluation form sent by TRI 120

Appendix 4 - Tea tablet photographs 121

LIST OF TABLES

		Page
Table 1:	Contents of tea polyphenols in tea flush	09
Table 2:	Flow properties and corresponding angle of repose	24
Table 3:	Flow properties and corresponding compressibility index	25
Table 4:	Average mass of the tablets and corresponding percent deviation by individual tablet mass	28
Table 5:	Absorbance values for tea solutions in Folin-Ciocalteu assay	36
Table 6:	Absorbance values for tea solutions in aluminium chloride colorimetric assay	38
Table 7:	Absorbance values for solutions P, Q and R in the method of Roberts and Smith	39
Table 8:	Average values of absorbance of brewed tea and instant tea	46
Table 9:	Reduction of total phenols in tea during oxidation at different pH values	55
Table 10:	Reduction of total phenols in tea during oxidation at different temperatures at pH = 9.6	56
Table 11:	Reduction of total phenols in tea during oxidation at different hydrogen peroxide concentrations at 60 °C at pH = 9.6	57
Table 12:	Average values of absorbance of brewed and instant tea in TBARS assay	61
Table 13:	Composition of formulations for 500 mg of tablet	62

Table 14:	Percentage relative humidities of salts used for the test at 20 – 25 °C	65
Table 15:	Height, diameter and angle of repose of the powder cone in each formulation	66
Table 16:	Bulk volume, tapped volume and compressibility index in each formulation.	67
Table 17:	Estimated median for the variation of sensory characteristic in brewed and instant tea	74
Table 18:	Sensory comparison of brewed tea with instant tea samples	75
Table 19:	Total phenol contents in brewed and instant cups of tea	77
Table 20:	Total flavonoid contents in brewed and instant cups of tea	78
Table 21:	TF and TR contents in brewed and instant cups of tea	79
Table 22:	IC_{50} values of brewed and instant tea in the $DPPH^{\bullet}$ scavenging assay	88
Table 23:	IC_{50} values of brewed, instant tea and trolox in the $ABTS^{\bullet+}$ scavenging assay	89
Table 24:	Total caffeine contents in brewed and instant cups of tea	90
Table 25:	Initial rates of oxidation of phenols (GAE) in tea at different pH values	92
Table 26:	Initial Rates of reaction at different peroxide concentrations at pH = 9.6	95

Table 27:	Effect of temperature on initial rate of reaction	95
Table 28:	*In vivo* antioxidants effects of brewed and instant tea in the TBARS assay	97
Table 29:	Different physical properties of formulations	99
Table 30:	Percentage moisture gain of instant tea powder formulations	101
Table 31:	Physical properties of tea tablets in different formulations	102
Table 32:	Physical properties and antioxidant activity of tea tablets from formulation J after storage at ambient temperature and humidity for 12 months at real time	103
Table 33:	Physical properties and antioxidant activity of tea tablets from formulation J after storage at 60 °C in an oven for 21 days at accelerated time	103
Table 34:	Effect of light on colour of tea tablets in different storage conditions	104
Table 35:	Microorganisms in different packaging materials with real time (1 year)	105
Table 36:	Microorganisms in different packaging materials with accelerated time (21 days)	105

LIST OF FIGURES

		Page
Figure 1:	Apical portion of a tea branch showing the tea flush in the encircled region. The polyphenol contents of the different leaves and stem are also indicated	03
Figure 2:	Three major categories of tea	05
Figure 3:	Structures of major flavan-3-ols in tea	10
Figure 4:	Oxidation of flavan-3-ols to theaflavins and thearubigins	12
Figure 5:	Structures of four major types of TF in black tea	13
Figure 6:	Structure of caffeine	15
Figure 7:	Absorbance vs. concentration of gallic acid	36
Figure 8:	Absorbance vs. concentration of quercetin	37
Figure 9:	Percentage scavenged of DPPH vs. concentration of brewed tea solution	44
Figure 10:	Percentage scavenged of DPPH vs. concentration of instant tea solution	45
Figure 11:	Percentage scavenged of $ABTS^{\bullet+}$ vs. concentration of trolox	47
Figure 12:	Percentage scavenged of $ABTS^{\bullet+}$ vs. concentration of brewed tea solution	47
Figure 13:	Percentage scavenged of $ABTS^{\bullet+}$ vs. concentration of instant tea solution	48
Figure 14:	Standard curve for FRAP assay	49

Figure 15:	Absorbance vs. concentration of brewed tea solution	50
Figure 16:	Absorbance vs. concentration of instant tea solution	50
Figure 17:	Peak area vs. concentration of caffeine	52
Figure 18:	Experimental set up for measuring angle of repose	65
Figure 19:	HPLC chromatogram of brewed tea	81
Figure 20:	HPLC chromatogram of instant tea	81
Figure 21:	HPLC chromatogram of theaflavin fraction of brewed tea	83
Figure 22:	HPLC chromatogram of theaflavin fraction of instant tea	83
Figure 23:	Sephadex LH-20 chromatogram of brewed tea	85
Figure 24:	Sephadex LH-20 chromatogram of instant tea	85
Figure 25:	Ethyl acetate soluble thearubigins on Sephadex LH-20 chromatogram of brewed tea	86
Figure 26:	Ethyl acetate soluble thearubigins on Sephadex LH-20 chromatogram of instant tea	86
Figure 27:	Oxidation of tea phenols with hydrogen peroxide at different pH values.	92
Figure 28:	- Log rate vs. - log hydroxyl ion concentration	93
Figure 29:	Oxidation of tea phenols at a hydrogen peroxide concentration of 1.23 mol dm^{-3}	94
Figure 30:	Oxidation of tea phenols at a hydrogen peroxide concentration of 2.49 mol dm^{-3}	94
Figure 31:	Oxidation of tea phenols at a hydrogen peroxide concentration of 3.71 mol dm^{-3}	94

ABBREVIATIONS

ABTS	2,2′-azinobis(3-ethylbenzothiazoline-6-sulfonic acid
CTC	cut, tear and curl
ALU	aluminium
C	catechin
CFU	colony forming unit
CSDA	casein soya bean digest agar
Da	Dalton
DPPH	2,2-diphenyl-1-picrylhydrazyl
DT	disintegration time
EC	epicatechin
ECG	epicatechin gallate
EGC	epigallocatechin
EGCG	epigallocatechin gallate
FCR	Folin - Ciocalteu's phenol reagent
GA	gallic acid
GAE	gallic acid equivalents
GC	gallocatechin
GPR	general purpose reagent
HPLC	high performance liquid chromatography
ISO	international standards organization
LLDPE	linear low density polyethylene
MCC	microcrystalline cellulose
PBS	phosphate buffer saline

PET	polyester
PPO	polyphenol oxidase
Q	quercetin
QE	quercetin equivalents
TAMC	total aerobic microbial count
TBA	2-thiobarbituric acid
TF	theaflavins
TF3′G	theaflavin-3′-gallate
TF3G	theaflavin-3-gallate
TFDG	theaflavin-3,3′-digallate
TLAF	triple laminated aluminium foil
TPTZ	2,4,6-tripyridyl-s-triazine
TR	thearubigins
TRI	tea research institute
UV-VIS	ultra violet – visible
WHO	world health organization

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ABSTRACT

The tea plant *Camelia sinensis* is an evergreen plant which grows under different climatic conditions in Sri Lanka and makes a significant contribution to the economy of Sri Lanka. There is a growing interest in dietary health supplements and tea can be an important source of dietary antioxidants, with its associated health benefits such as reduced risk of cardiovascular disease and cancer. Due to the fast pace of modern life there is a growing interest in ready to drink beverages and instant tea is becoming increasingly popular as a beverage.

The concentration of a hot solution of an industrially produced instant tea powder which is organoleptically equivalent to a standard cup of brewed tea was determined by a thirty member sensory panel. The characteristics chosen were strength, flavour, colour, brightness and overall acceptability. A brewed tea beverage prepared by steeping 1.4 g of black tea in 140 mL of freshly boiled water for 3 minutes was found to be organoleptically equivalent to a beverage of instant tea prepared by dissolving 0.21 g of instant tea in freshly boiled water in the same volume. The total phenols and total flavonoids contents of the equivalent instant and brewed tea beverages were determined

using the Folin Ciocalteu assay and the aluminium chloride colorimetric assay respectively. Phenolic content of a cup of instant tea (704.9 ± 0.7 mg gallic acid equivalents (GAE)) was much lower than a cup of brewed tea (1090.6 ± 3.8 mg GAE). The total flavonoid contents of a cup of instant tea prepared from tea powder (28.4 ± 0.8 mg quercetin equivalents (QE)) was also much lower than that of a cup of brewed tea (61.9 ± 0.4 mg QE). Similarly the theaflavins and thearubigins content determined spectroscopically were found to be lower in instant tea (1.06 and 89.32 mg/tea cup respectively) compared to brewed tea (89.32 and 322.00 mg/tea cup respectively). The *in vitro* antioxidant potential of the two tea beverages were determined based on their IC_{50} values in the scavenging of the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical, 2,2′-azinobis(3-ethylbenzothiazoline-6-sulfonic acid) radical cation and by their ferric reducing antioxidant power (FRAP value). The IC_{50} values of brewed and instant tea obtained for $ABTS^{\bullet+}$ (6.3 and 17.8 μg/mL respectively) are lower than the IC_{50} values obtained for DPPH radicals (8 μg/mL and 20 μg/mL respectively) but is of the same order of magnitude. FRAP value of brewed tea is also higher than that of instant tea (2100 and 980 μM Fe (II)/g respectively). These figures indicate that brewed tea has a higher antioxidant potential than instant tea *in vitro*. However, the *in vivo* antioxidant capacity of instant and brewed tea was found to be similar as measured by their effect on the serum and tissues of the heart and lung in mice, at a dose equivalent to twelve cups of tea a day.

The conditions for preparing a hot water soluble tablet from the instant tea powder were optimized. A series of ten formulations were prepared based on the physical properties of moisture absorption, angle of repose, compressibility index and moisture content. The formulation consisting instant tea powder (42 %), anhydrous lactose (56.3 %),

microcrystalline cellulose (1.0 %), aerosol (0.2 %) and magnesium stearate (0.5 %) was chosen as the best formulation. Direct compression tablets (250 mg) were made using this formulation to obtain tablets having acceptable values for thickness, hardness, disintegration time, friability and percentage moisture absorption (5.3 mm, 5.0 kPa, 6 min, 0.14 % and 7.62 respectively).

Real time and accelerated stability studies indicate that the formulated tea tablets are microbiologically stable and retain their antioxidant potential when stored in screw capped amber glass bottles or in triple laminated aluminium foil at room temperature for one year.