DEVELOPMENT OF VALUE-ADDED TEA FROM THEBU (*COSTUS SPECIOSUS L.*) LEAVES

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Non-communicable diseases (NCDs) are a leading cause of deaths worldwide. Tea is the most widely consumed beverage next to water and therefore phytochemical rich herbal teas could be good alternatives in the prevention and management of NCDs. *Thebu (Costus speciosus L.)* is a well-known anti-diabetic plant having various health benefits. This study aimed to develop a *Thebu* tea product and to study its physicochemical and anti-oxidant properties. Three different maturity stages namely immature, partially mature and mature leaves were dried at 50, 60 and 70 °C until the moisture content reaches 8-10 % (w/w). Further, effectiveness of blanching on drying was tested by blanching leaves at 60°C, 70°C and 80°C for 3-5 min. The best samples were selected based on the colour and were ground (850µm) and *Thebu* tea was prepared (2.00 g/tea bag). Then, physicochemical (moisture, total ash content, water activity, colour and pH; n=3 each), and antioxidant properties [total polyphenol content (TPC; n=3 each), total flavonoid content (TFC; n=3 each), ferric reducing antioxidant power (FRAP; n=3 each) and DPPH & ABTS radical scavenging activities; n=3 each] were studied. Results showed that blanching was not an effective pre-treatment in any stages of *Thebu* leaves drying. Immature, partially mature and mature leaves dried at 50°C for 7-8 hrs was the best time temperature combination. Interestingly, *Thebu* tea formulated from immature leaves exhibited significantly ($P<0.05$) high antioxidant properties for all the tested antioxidant activities (TPC: 0.77±0.11 mg GAEs/200ml tea cup; TFC: 2.02±0.05 mg QEs/200ml tea cup; FRAP: 5.74±0.25 mg TEs/200ml tea cup; DPPH: 53.32±19.7 mg TEs/200ml tea cup; & ABTS: 50.62±1.26 mg TEs/200ml tea cup) compared to the other maturity stages studied. Further, it also showed desirable physicochemical properties (water activity: 0.453±0.01; ash content: 14.42±0.11%; Colour: L*=39.38±0.25, a*-10.82±0.01, b*21.93±0.01; & pH=5.81±0.01). Considering all, it is concluded that, *Thebu* tea formulated from immature leaves has the greatest potential as a value-added functional tea which can be commercialized in the long run.

Keywords: *Thebu* leaves, blanching, maturity stages, physicochemical & antioxidant properties, value-added tea

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INTRODUCTION

Non-communicable diseases (NCDs) are a leading cause of deaths worldwide. Tea is the most widely consumed beverage next to water and therefore phytochemical rich herbal teas could be a good alternative in the prevention and management of NCDs (Zou *et al.*, 2021). *Thebu* (*Costus speciosus .L*) is a well-known anti-diabetic plant having various health benefits (Malabadi *et al.*, 2016). Functional foods offer great potential to improve health and help prevention and management of chronic diseases (Chandrasekara and Darshani, 2017). Phytochemical rich herbal tea could be used in the prevention and management of such diseases. This study aimed to develop a *Thebu* tea product and to study its physiochemical and anti-oxidant properties.

METHODOLOGY

Materials

Sample Collection

Thebu (*Costus speciosus L.*) leaves were collected from home gardens from the Homagama area in Colombo district, Sri Lanka. Three different stages namely immature, partially mature and mature leaves were used for the study. Maturity stages were selected based on visual observations considering the physical properties such as leaf colour, size, shape, texture, firmness etc. *Thebu* leaves were harvested early in the morning. All wilting and visibly deceased plant materials were removed.

Chemicals and Reagents

Methanol, Sodium Carbonate, Monosodium dihydrogen orthophosphate, Disodium monohydrogen orthophosphate, Sodium Chloride, Gallic acid, 6-hydroxy-2-5-7-8-tetramethylchroman-2-carboxylic acid (Trolox), Folin-Ciocalteu reagent, 2,2-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) diammonium salt (ABTS), Potassium persulphate, 1,1-diphenyl-2-picryl-hydrazyl(DPPH), Sodium acetate tetrahydrate, glacial acetic acid, NaOH, Ferric chloride, 2,4,6-tripyridyl-s-traizine(TPTZ) were obtained from Sigma-Aldrich. All the other chemicals used for preparation of buffers and solvents were analytical grade.

Methods

Sample preparation

Disease free samples were selected and the fresh leaves were washed well with running water/Clorex and cut it into small pieces (1.5cm×1.5cm to 2cm×2cm). Initially the weight of the *Thebu* leaves was obtained and spread on aluminum trays.

Development of drying technologies for *Thebu* leaves

The leaves were oven dried at 50°C, 60°C and 70°C until the moisture content was 8-10 % (W/W). Then, moisture content, water activity, color and physical appearance were determined. The selected best dried *Thebu* samples based on physicochemical properties were

used to study the effectiveness of blanching on *Thebu* leaf drying. The leaves were washed and sliced and subjected to blanching in hot water at temperatures of 60°C, 70°C, and 80°C for 1-2 minutes. After being blanched, the slices were placed in cold water at -4°C for 30 seconds. Drying was carried out at selected temperatures of 50°C and 60°C using a conventional drying oven. Subsequently, color and moisture content of the samples were measured. The dried *Thebu* leaf samples (both blanched and un-blanched) were compared, and the best samples were selected for formulation of *Thebu* tea.

Formulation of *Thebu* tea and brew

Dried leaves were ground using a laboratory grinder and sieved using 850 µm sieves. The ground leaves were packed in tea bags. Tea brew was prepared according to the ISO 3103 standard method. 2.00g of tea samples were weighed and samples were brewed in boiling water (200mL). The tea brews were filtered using filter paper.

Physicochemical properties of *Thebu* tea

Physicochemical properties (moisture ISO 1573:1980, total ash content ISO 1575:1987, water activity, colour and pH ISO 3071:2020; n=3 each) were determined according to ISO standard methods.

Antioxidant properties of *Thebu* tea

Thebu tea extracts were evaluated for total polyphenol content (TPC: Singleton et al., 1999), total flavonoid content (TFC: Siddhuraju and Becker, 2003), ferric reducing antioxidant power (FRAP: Benzie and Szeto, 1999) and 2,2-diphenyl-2-picrylhydrazine (DPPH) & 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) diammonium salt (ABTS: Re et al., 1999) radical scavenging activities (n=3 each) (Abeysekera *et al.*, 2018).

RESULTS AND DISCUSSION

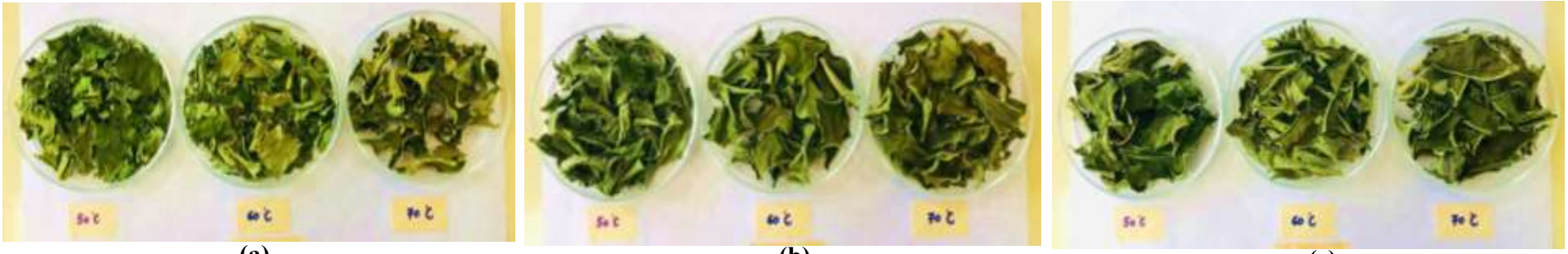
Physico-chemical properties of developed *Thebu* tea are given in Table 1.

Table 01: Physico-chemical properties of formulated *Thebu* tea

Samples		Immature	Partially mature	Mature
Moisture content		4.86±0.02^{a}	4.84±0.01^{a}	4.87±0.02^{a}
Water activity		0.453±0.015^{a}	0.471±0.003^{a}	0.476±0.001^{a}
Ash content		14.42±0.11^{a}	13.57±0.02^{b}	12.97±0.11^{c}
Colour	L*	39.38±0.25^{a}	38.80±0.73^{a}	32.97±0.34^{b}
	a*	-10.82±0.01^{c}	-9.89±0.19^{b}	-4.16±0.39^{a}
	b*	21.93±1.01^{a}	19.29±0.45^{b}	14.92±0.17^{c}
pH (Tea brew)		5.81±0.01^{b}	5.94±0.01^{a}	5.92±0.02^{a}

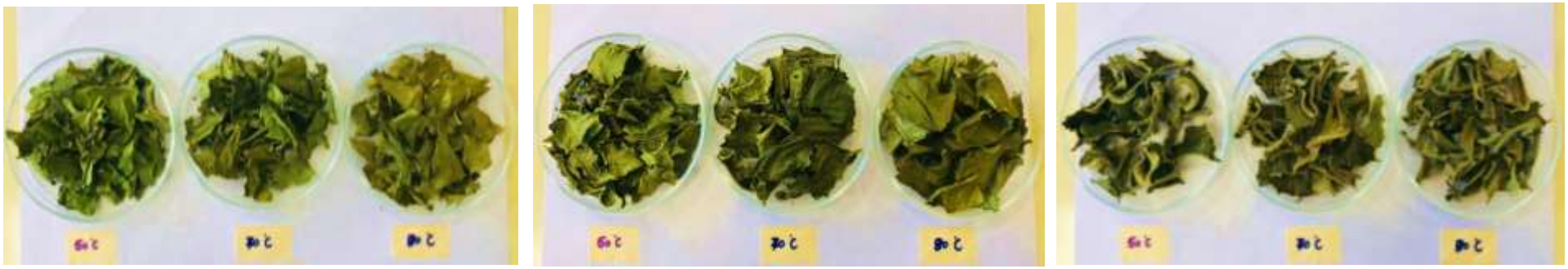
Data represented as (n=3 each) mean ± SE, mean physicochemical properties results super-scripted by different letters are significantly different at $p<0.05$

Effectiveness of blanching on *Thebu* leaves drying was given in Figure 1, Figure 2 and Figure 3. Results showed that blanching was not an effective pre-treatment at any stage of *Thebu* leaves drying.



(a) **(b)** **(c)**

Figure 1: Dried *Thebu* leaves (a) immature stage at (50°C, 60°C, 70°C) (b) partially mature stage at 50°C, 60°C, 70°C and (c) mature stage at 50°C, 60°C, 70°C



(a) **(b)** **(c)**

Figure 2: Blanched *Thebu* leaves at different temperatures (60°C, 70°C, 80°C) and dried at 50°C (a) immature stage (b) partially mature stage and (c) mature stage

(a) **(b)** **(c)**

Figure 3: Blanched *Thebu* leaves at different temperatures (60°C, 70°C, 80°C) and dried at 60°C (a) immature stage (b) partially mature stage and (c) mature stage

Antioxidant properties of developed *Thebu* tea are given in Table 2.

Table 02: Antioxidant results of *Thebu* tea samples

Tea Sample	TPC (mg GAEs/cup)	TFC (mg QEs/ cup)	FRAP (mg TEs/ cup)	DPPH (mg TEs/ cup)	ABTS (mg TEs/ cup)
Immature	7.77 ± 0.11^{a}	2.02 ± 0.05^{a}	5.28 ± 0.14^{a}	53.32 ± 19.7^{a}	51.51 ± 1.26^{a}
Partially mature	6.92 ± 0.30^{b}	1.52 ± 0.04^{b}	5.74 ± 0.25^{b}	42.56 ± 6.86^{a}	23.74 ± 1.36^{a}
Mature	6.17 ± 0.16^{c}	1.40 ± 0.05^{b}	5.63 ± 0.28^{b}	57.46 ± 7.69^{a}	21.94 ± 0.24^{a}

Data represented as (n=3 each) mean ± SE, Mean antioxidant properties results super-scripted by different letters are significantly different at p<0.05; Tea cup: 200 ml

Results showed that, immature, partially mature and mature leaves dried at 50°C for 7-8 hrs was the best time-temperature combination. Interestingly, *Thebu* tea formulated from immature leaves exhibited significantly (P<0.05) high antioxidant properties for all the tested antioxidant activities (TPC: 0.77±0.11 mg GAEs/200ml Tea cup; TFC: 2.02±0.05 mg QEs/200ml Tea cup; FRAP: 5.74±0.25 mg TEs/200ml Tea cup; DPPH: 53.32±19.7 mg TEs/200ml Tea cup; & ABTS: 50.62±1.26 mg TEs/200ml Tea cup) and better physicochemical properties.

CONCLUSION

It is concluded, that *Thebu* tea formulated from immature leaves has the greatest potential as a value-added functional tea which can be commercialized in the long run.

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REFERENCES

Chandrasekara, A. and Darshani, N. (2017) 'Role of Functional Foods in Non Communicable Diseases (NCDs) Management in Sri Lanka', (January), pp. 1–3.

Malabadi, R.B. *et al.* (2016) 'Insulin Plant, Costus speciosus: Ethnobotany and Pharmacological Updates', *International Journal of Current Research in Biosciences and Plant Biology*, 3(7), pp. 151–161. Available at: http://www.ijcrbp.com/abstractview.php?ID=131&vol=3-7-2016&SNo=21.

Abeysekera, W.KS.M. *et al.* (2018) 'Anti-Glycation and Glycation Reversing Potential of Fenugreek (Trigonella Foenum-Graecum) Seed Extract', 3(1), pp. 3138–3142. Available at: https://doi.org/10.26717/BJSTR.2018.03.000875.

Zou, K.H. *et al.* (2021) 'Harnessing real-world evidence to reduce the burden of noncommunicable disease : health information technology and innovation to generate insights', *Health Services and Outcomes Research Methodology*, 21(1), pp. 8–20. Available at: https://doi.org/10.1007/s10742-020-00223-7.