EXTENDED ABSTRACT

EFFECT OF ADDITION OF MALTODEXTRIN ON TOTAL POLYPHENOL CONTENT (TPC), ANTIOXIDANT ACTIVITY AND COLOUR OF BLACK TEA

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Abstract

During tea leave processing, maltodextrin is added illegally in order to improve the taste, color, to satisfy sensory needs of consumers and also to gain the weight after drying. Therefore this study was undertaken to determine the effect of maltodextrin on physiochemical properties of Ceylon black tea. Tea leave samples grown from of low, mid and up country were adulterated with 3, 6 and 10% maltodextrin solutions (w/v) and dried to obtain black tea. The non-adulterated samples were used as control. Each treatment has three replicates. The hot water extraction of black tea samples were analyzed for total polyphenol content (TPC), antioxidant activity and colour (Lab) by standard methods. The highest TPC (48.40 ± 0.15 mg GAE/ 100 ml) was recorded in control from up country sample and lowest TPC was observed in mid country sample with maltodextrin (10%) addition. The DPPH antioxidant concentration from low, mid and up country tea samples were varied in the range of 2.13 – 2.74 mg/ml, 2.39 – 3.78 mg/ml and 0.57 – 0.95 mg/ml, respectively. The results were revealed that TPC and antioxidant activity in low, mid and up country significantly decreased ($p<0.05$), however brightness was not significantly decreased, with increasing the maltodextrin concentration. This study will make awareness on effect of adulteration of phytochemicals in black tea among people.

Keywords: Polyphenol, antioxidant, black tea, maltodextrin

1. Introduction

Tea is one of the most popular and consumed beverage next to water which obtained from the pure fresh tea leaves of Camellia species. Tea is very rich in various groups of compounds such as polyphenols, alkaloids, free amino acids, proteins and vitamins.(Tounekti et al., 2013). According to the SLS 135:2009 specification for black tea, tea should not contain any contaminants, undesirable substances or any extraneous matter. But during the processing, sucrose and carbohydrate derivatives like glucose syrup and maltodextrin are added illegally in order to improve the taste, color, to satisfy sensory needs of consumers and also to gain the weight after drying. These substances may leads the quality deterioration of tea and some health issues of the consumers (Wang et al., 2021). Maltodextrin is a hydrolyzed starch product with a dextrose equivalent (DE) less than 20, prepared by the partial hydrolysis of a food grade starch with acid or enzyme (Susantikarn and Donlao, 2016).

Many researches have investigated the effect of maltodextrin concentration on the bioactive compounds of green tea extractions during the spray drying process. But there is no evidence of the effect of maltodextrin on quality of the tea infusion.
This study was done to determine the effect of maltodextrin on physiochemical properties of Ceylon black tea.

2. Methodology

2.1 Preparation of samples

Initially 100 g of tea leave samples in fermented stage cultivated from up, mid and low country were sprayed in with 100ml of maltodextrin in 3%, 6% and 10% (w/v)concentrations and samples without maltodextrin used as a control. Then the samples were kept for 01 hour to further fermentation and dried at inlet temperature 120 °C and outlet temperature 80 °C using dehydrator for 20 minutes.

2.2 Preparation of extraction

Initially 2 g of dried tea samples were extracted with 50 ml of distilled water at 100 °C and vortex the sample for 2 minutes and allow 30 min for extraction. The samples were centrifuged at 3500 rpm for 15 minutes then filtered through Whatman no 1 filter papers. The residues were re- extracted by repeating the procedure.

2.3 Determination of polyphenol content

The total polyphenol content (TPC) of the tea samples were determined by using the Folin-Ciocalteu method as described by ISO 14502-1-2005E.

2.4 Determination of Antioxidant activity

2, 2- diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging assay was carried out in triplicate to test for their antioxidant activity as described in Aboagye et al., 2021.

2.5 Determination of colour

The colour of same volumes of brewed tea extracts was measured using the chromameter. The color was expressed as 3 wavelengths L^*, a^* and b^* described in Jin et al., 2016.

2.6 Statistical analysis

All experiments were done in triplicate (n=3) and results were expressed as mean ± SD. The results were analyzed by using the Minitab 18 statistical software.

3. Results and discussion

3.1 Total polyphenol content

The effect of maltodextrin concentration on total polyphenol content (TPC) shows in the table 1. The TPC of low, mid and up country tea samples changed in the range of 29.14 - 39.84 mg GAE/ 100 ml, 19.62 - 32.40 mg GAE/ 100 ml and 37.68 – 48.20 mg GAE/ 100 ml respectively. The highest value was found from the control sample and lowest value was found from the 10 % maltodextrin added tea samples. TPC of tea was significantly reduced when the maltodextrin concentration was increased control to 10%. Hence, the addition of maltodextrin significantly affects ($p<0.05$) the TPC of black tea.

Table 1: Effect of maltodextrin concentration on total polyphenol content of tea samples

Added %	Total polyphenol content (mg GAE/ 100 ml)		
	Low Grown	Mid Grown	Up Grown
Control	39.84 ± 0.04^{a}	32.40 ± 0.15^{a}	48.20 ± 0.11^{a}
3 %	34.54 ± 0.04^{b}	27.08 ± 0.08^{b}	46.62 ± 0.08^{b}
6 %	32.38 ± 0.04^{c}	21.32 ± 0.13^{c}	41.04 ± 0.15^{c}
10 %	29.14 ± 0.04^{d}	19.62 ± 0.19^{d}	37.68 ± 0.22^{d}

Data presented as mean values for triplicates ± SD (n = 3). Numbers with different lowercase letters in same columns are significantly different at ($p < 0.05$) level.

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3.2 Antioxidant activity

The antioxidant activity expressed as the percentage inhibition activity with reference to the IC50 value. High IC50 value indicates lower antioxidant activity while low IC50 value indicates the high antioxidant activity (Chan, Lim and Chew, 2007). Table 2 shows the effect of maltodextrin (%) on DPPH radical scavenging activity of black tea.

Table 2: Effect of maltodextrin concentrations antioxidant activity of tea samples

Added %	DPPH antioxidant concentration (mg/ml)		
	Low grown	Mid grown	Up grown
Control	2.13	2.39	0.57
3 %	2.74	4.02	0.67
6 %	2.89	3.75	0.78
10 %	3.26	3.78	0.95

Data presented as mean values for triplicates ± SD (n = 3).

The highest DPPH antioxidant concentration was observed from the 10 % maltodextrin added tea samples resulting the lowest antioxidant activity while the lowest DPPH antioxidant concentration was observed from the control (0% maltodextrin) samples showing the highest antioxidant activity.

When increasing the maltodextrin concentration, the IC50 concentration was increased. This shows the antioxidant activity of tea was decreased with the maltodextrin content control to 10 %. The addition of maltodextrin significantly ($p<0.05$) affect the antioxidant activity of black tea. Tea polyphenols are responsible for the antioxidant activity of tea. The antioxidant activity was decreased due to the decrement of TPC with maltodextrin content (Caliskan and Nur Dirim, 2013).

3.3 Colour of tea infusion

Colour is an important sensory parameter it enhance the consumer preference of tea. The results of colour measurement (L*, a* and b* values) of adulterated black tea infusion shows in the figure 1.

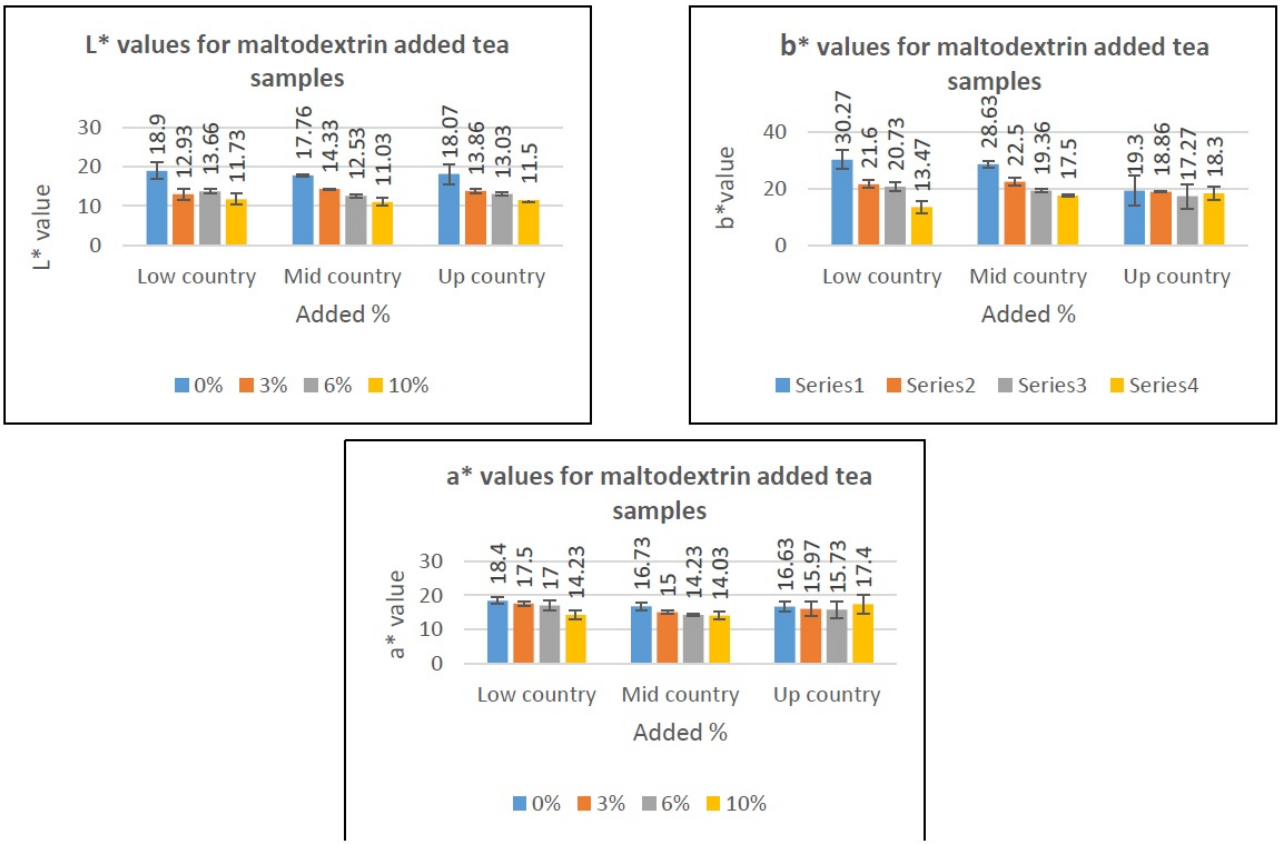

Figure 1. Chroma meter values for tea infusion samples

The highest L*values responsible for lightness and lower L* values responsible for darkness resulted L* values are decreased slightly with the maltodextrin concentration control to 10 %. The higher L* value gives control samples and the lower ones give 10 % maltodextrin added samples. Decrement of L* value indicates that the increment of darkness. The addition of maltodextrin affect the brightness and attractive colour of black tea infusion. The colour may slide towards the darkness when increasing the maltodextrin concentration because maltodextrin caramelize when drying. There is no significant change of a* values and b* values with the maltodextrin content 3-10 %. Therefore, addition of maltodextrin was not affected significantly ($p>0.05$) to the yellowness and redness of the tea infusion.

3.4 Conclusion

When increasing the maltodextrin content, total polyphenol content was decreased and IC50 value was increased indicating the decreasing of antioxidant activity of black tea. When decreasing the polyphenol content, shows the lower antioxidant activity. When increasing the maltodextrin content, the L* values were decreased and a* and b* values were not changed significantly. Adulteration with maltodextrin contents were significantly affected ($p<0.05$) on the total polyphenol content,

antioxidant activity, brightness and attractive colour of black tea. This study will make awareness on effect of adulteration on phytochemicals in black tea among people.

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