Development of Green Tea Enriched Crackers

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Introduction

Green tea has high beneficial characters than the other processed tea such as black tea and oolong tea. It is a source of anti oxidants that can be used in food lipid stabilization (Mildner-Szkudlarz *et al*., 2009). Keeping in view on the above factor, this study was designed to develop a green tea enriched crackers and evaluate its physiochemical and sensory qualities.

Methodology

The green tea particles were powdered using a grinder. Cracker samples were processed from dough containing 0, 1, 2 and 3% green tea powder, brew and powder with brew in 1:1 ratio. The formula used was as follows: 165 g wheat flour, 22.3 g vegetable fat, 3.2 g salt, 2.3 g malt syrup, 2 g glucose syrup, 1 g yeast, 0.5 g Ammonium carbonate and 40 ml of water. Ammonium bicarbonate and yeast was dissolved in water and added. The contents were mixed for 15 min and left to ferment for 4 hours. Green tea was added to the dough and mixed for 2 min. Then the dough pieces were sheeted to a thickness to 3.5 mm, cut using 8cm square cutter and baked at 270 to 380 °C for 8 min. Then crackers were left to cool at room temperature and were wrapped tightly with poly propylene pouches and kept until further analysis. Sensory analysis was performed by 30 untrained panelists using five point hedonic scale. Control crackers were used as the reference. Crackers were analyzed for their moisture content, crude fiber, protein, fat, ash, carbohydrate and pH according to the methods described in AOAC. Total poly phenolic content and antioxidant activity also measured to analyze the quality of product. Final product was analyzed for *E-coli*, *Staphylococcus aureus*, Yeast and mould count and total colony count (TCC).

Sensory data were statistically analyzed using Friedman test with $p<0.05$ being considered statistically significant. The polyphenol content and proximate analysis of two samples were compared using two sample t-tests. All statistical analyses were conducted with MINITAB 15.

Results and Discussion

Preliminary sensory evaluation was conducted to select the best concentration of green tea in powder form, brew and both (1:1 powder:brew). 2% powder, 3% brew and 1% both powder: brew (1:1) were selected from experiment I, II and III respectively (Table 1, 2 and 3).

Table 1. Sensory attributes of green tea powder and control (Experiment I)

Powder	Control (0%)	T 1 (1%)	T 2 (2%)	T 3 (3%)	P value
overall acceptability	3.4375	3.5625	4.3125*	3.4375	0.020

Values indicate the highest estimated median for particular sensory character at $p<0.05$

Table 2. Sensory attributes of green tea brew and control (Experiment II)

Brew	Control (0%)	T 1 (1%)	T 2 (2%)	T 3 (3%)	P-value
Overall acceptability	3.1250	3.8750	4.1250	4.3750*	0.000

Values indicate the highest estimated median for particular sensory character at $p<0.05$

Table 3. Sensory attributes of green tea brew: powder 1:1 ratio and control (Experiment III)

Powder : Brew 1:1	Control (0%)	T 1 (1%)	T 2 (2%)	T 3 (3%)	P-value
Overall acceptability	3.9375	4.5625*	3.1875	4.0625	0.000

Values indicate the highest estimated median for particular sensory character at $p<0.05$

Powder form with 2% incorporation was selected as the best form from the experiment IV. Attributes such as color, taste, aroma and overall acceptability showed higher estimated median scores for 2% powder compared to other treatments. But in case of brew and both, 1% and 3% showed the highest scores for all attributes. But the final sensory revealed that 2% green tea powder is the most suitable form for the incorporation.

Table 4. Sensory attributes of best forms selected from experiment I,II and III (Experiment IV)

Attributes	Control (0%)	T 1 (1% both)	T 2 (2% powder)	T 3 (1% brew)	P-value
Appearance	3.4375	3.1875	4.3125*	3.8125	0.000
Color	3.3750	3.8750	4.1250	4.1250	0.011
Texture	3.6250	3.6250	4.3750*	3.8750	0.000
Crispiness	3.3438	3.9688	4.0938*	3.9688	0.006
Taste	3.6250	3.7500	4.2500*	3.8750	0.047
Aroma	3.3750	3.6250	4.3750*	4.1250	0.000
Overall acceptability	3.0625	4.0625	4.1875*	3.9375	0.000

Values indicate the highest estimated median for particular sensory character at $p<0.05$

The results of proximate analysis, total phenolic and antioxidant activity of final product and control are presented in table 5. The most significant difference between the product and the control was the presence of higher polyphenol content and antioxidant activity in the product compared with the control. The product was significantly lower in total energy and fat level and significantly higher in ash content.

Table 5. Proximate composition (g/100g dry sample), total phenolic and antioxidant activity of product and control

Component	Average Quantity per 100g		
	Control	Final product	P-value
Energy	441.6462 cal	424.027 cal	0.036
Carbohydrate	70.9650g	71.520g	0.632
Crude fat	13.7210g	11.003g	0.015
Crude protein	8.5793g	9.730g	0.999
Crude fiber	0.6347g	0.800g	0.997
Ash	2.4300g	3.600g	0.018
Polyphenol	19.13 mg	191.22 mg	0.004
Antioxidant activity (IC_{50})	2.6×10^{4}ppm	1.5×10^{4}ppm	

The moisture content and pH in final product was constant with the six weeks of storage period. It enhances the product quality and prevents the microbial contamination. *E-coli* and *Staphylococcus aureus* was absent within the sample and the yeast and mould count and TCC were below the standards.

Conclusions

The best amount for the product development is incorporation of 2% green tea powder. Developed product met the standard requirements of SLSI for the microbial count, moisture

content and pH value. During the six week storage period 2% green tea incorporated cracker shown the higher level of polyphenol content than the commercially available cream cracker.

Since the scope of this research is limited, it is suggested that the present investigation may be continued to enhance the color and the medicinal value of the product using the green tea extract powder rather than the green tea dust.

Reference

Mildner-szkudlar, S., Zawirska, W.R., Obuchowski, W., Goslinski, M., 2009. Evaluation of antioxidant activity of green tea extract and its effect on the biscuits lipid fraction oxidative stability. Journal of Food Science, 74(8), 362-370.