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Development of butterfly pea powder incorporated cookies and their physicochemical properties

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Abstract

The current study was designed to develop the butterfly pea powder incorporated cookies and determined their physicochemical properties. The experimental products namely T₁, T₂, T₃ and T₄ were developed and subjected for sensory analysis. The results indicated that the experimental product T₄ was superior to other formulations in terms of sensory parameters. The experimental product T₄ got highest score in color (8.78±0.44), taste (8.66±0.54), texture (8.42±0.79), flavor (8.47±0.79), and overall acceptability (8.67±0.52) compared to other formulations. The highest protein content was observed in T₂ (6.48±0.04) and lowest in T₁, but the values were not significantly different (p< 0.05). The highest fat content was noted in T₃ (10.36±0.07), and lowest in T₂ (10.11±0.08). The fibre content was highest in T₁ (0.48±0.06) and lowest in T₂ (0.31±0.00). The highest ash content was observed in T₄ (0.58±0.05) and lowest in T₂ (0.46±0.02), the moisture content of the experimental products ranged from 9.51% to 9.85%. The carbohydrate content was varied from 82.62% to 72.20%. The proximate composition values were not varied much and all were nearest only.

Keywords: Butterfly pea powder, cookies, sensory evaluation

1. Introduction

Clitoria ternatea L. is a well-known herb that belongs to the family Fabaceae. The blue butterfly pea is a legume plant with a long, thin, climbing herbaceous vine with five leaflets, white to purple flowers, deep roots, and growing wild and in gardens in tropical regions. The vibrant blue hue of the butterfly pea flower petals are due to the presence of anthocyanin components called ternatin. Ternatins have been shown in test tube tests to reduce inflammation and they may inhibit the development of cancer cells (Nair *et al.*, 2015).

The plant also includes a number of other antioxidants, such as a) Kaempferol – A lot of research has been done on the capacity of this component to fight cancer. Studies in test tubes suggest that it could inhibit the development of cancer cells (Imran *et al.*, 2019 b) p-Coumaric acid – This component may have anti-inflammatory, antibacterial and antiviral properties that might aid in disease prevention. (Chayaratanasin *et al.*, 2015) c) Delphinidin-3,5-glucoside – This antioxidant may aid in enhancing immune response and causing colorectal cancer cells to die.

Potential Medicinal Value of Butterfly Pea Flower. A plethora of health benefits are associated with the butterfly pea flower petals, such as these petals support skin and hair health, aids in weight loss and normalize blood sugar levels. The butterfly pea, also known as Shankupushpam, is a popular brain tonic in traditional Indian medical systems and is thought to improve memory and intelligence. The efficacy of butterfly pea blossoms in everything from skin care serums to hair mists and shampoos is bragged about by cosmetic producers (Adisakwattana *et al.*, 2020; Christiani Dwiputri & Lauda Feroniasanti, 2019) ^[1, 6].

1.2 Extraction of butterfly pea powder

The BPFs were washed and placed on an aluminum tray and directed to the hot humid tropical sun for drying (31±5 °C, RH: 67±5%). The BPFs were dried until the flower's petals felt like parchment and were no longer soft or wet. Afterwards, dried flowers were grounded and packed in an airtight container and stored under ambient conditions (27 °C) until further use. The aqueous extraction method was performed to extract the anthocyanin from dried BPF (Marpaung *et al.*, 2017; Nhut Pham *et al.*, 2019) ^[9, 10].

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1.3 Health benefits

1. Boosts brain health
2. Lowers blood pressure
3. Helps with digestion
4. Serves as antidepressant
5. Strengthen healthy hair growth
6. Keeps skin glowing and protects it from premature aging
7. Good for eyesight
8. Aphrodisiac properties
9. Caffeine free
10. Rich in anti-inflammatory compounds

Butterfly pea powder is a natural nootropic due to a good content of anthocyanins, which means it can enhance memory or other cognitive functions. Its glamorous color is an irreplaceable natural dye for lattes, pancakes, smoothies, cocktails, and all the baked goodies in the world. Not only is its color fascinating, but it also presents with a unique after taste. You may expect it to taste fruit-like but it's actually herbal, grassy and somewhat earthy. As far as the nutrition value is concerned, it is loaded with vitamin A, C and E. So challenge your taste, and don't be afraid to try something new (Rogers *et al.*, 2018; Sokol *et al.*, 2021) ^[12, 14].

1.4 Cookies

A cookie, or a biscuit is a baked or cooked snack or dessert that is typically small, flat and sweet. It usually contains flour, sugar, egg, and some type of oil, fat, or butter. It may include other ingredients such as raisins, oats, chocolate chips, nuts, etc. Cookies are most commonly baked until crisp or else just long enough to ensure a soft interior (Supriatno *et al.*, 2021; Tien *et al.*, 2018) ^[15]

1.5 Butterfly pea flower powder

Butterfly pea flower is a common ingredient in many herbal teas, mixed drinks, and cosmetic products. It is rich in antioxidants and may be linked to several health benefits, including increased weight loss, better blood sugar control, and improvements in hair and skin health.

1.6 Butter

Butter is a dairy product made from the fat and protein components of churned cream. It is a semi-solid emulsion at room temperature, consisting of approximately 80% butterfat. It is used at room temperature as a spread, melted as a condiment, and used as a fat in baking, sauce-making, pan frying, and other cooking procedures. Butter, a yellow-to-white solid emulsion of fat globules, water, and inorganic salts produced by churning the cream from cows' milk. Butter has long been used as a spread and as a cooking fat. It is an important edible fat in northern Europe, North America, and other places where cattle are the primary dairy animals. In all, about a third of the world's milk production is devoted to making butter.

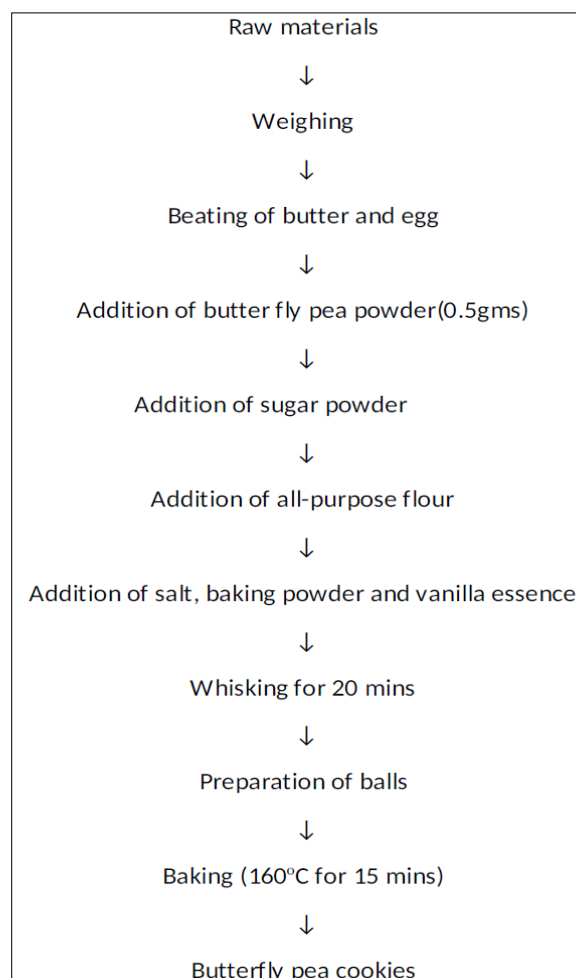
In aforementioned facts, this current study was designed to develop the butterfly pea powder incorporated cookies and to determine the physicochemical properties.

2 Materials and methods

2.1 Collection of raw materials

All the required ingredients and chemicals were purchased from local market.

2.2 Development of butterfly pea powder incorporated cookies



All the required materials were measured correctly and all are added to according the formulations and subjected for whisking for 20 min. The prepared balls were subjected for baking at 160 °C for 15 min and stored the butterfly pea cookies. The experimental products namely T1, T2, T3 and T4 were developed with different variations of butterfly pea powder. The preparation procedure was followed as per the methodology described by (Baskaran *et al.*, 2019) ^[4]

2.3 Sensory analysis

The experimental products T1, T2, T3 and T4 were subjected for sensory analysis using 80 untrained panel members by 9 point hedonic scale (Littardi *et al.*, 2020).

2.4 Proximate analysis

The experimental product was subjected for proximate analysis. The protein content was estimated by using Kjeldahl apparatus (with nitrogen conversion factor of 6.25). Fat content was estimated using soxlet apparatus, ash content (Muffle furnace) and moisture content was determined by using oven method. Carbohydrate content was calculated (Penchalaraju & John Don Bosco, 2022) ^[11].

2.5 Statistical analysis

The data was expressed as means±standard deviations from triplicate readings (Brishti *et al.*, 2020; Penchalaraju & John Don Bosco, 2022) ^[11].

3. Results and Discussion

3.1 Product development

Table 1: Different formulations for butterfly pea powder incorporated cookies

S. No.	Ingredients	T1	T2	T3	T4
01	All-purpose flour	100g	100g	100g	100g
02	Sugar	50g	50g	50g	50g
03	Butterfly pea powder	0.5g	1.0g	1.5g	2.0g
04	Butter	50g	50g	50g	50g
05	Egg	1	1	1	1
06	Salt	0.3	0.3	0.3	0.3
07	Baking powder	0.3	0.3	0.3	0.3
08	Vanilla essence	3 drops	3 drops	3 drops	3 drops

According to above formulations cookies were developed by adding butterfly pea powder. The developed cookies were subjected for sensory analysis to determine the best product in terms of taste, color, texture, flavor and overall acceptability (Lakshan *et al.*, 2019) [18]

3.2 Sensory analysis

Table 2: Sensory evaluation of developed products

Product name	Colour	Taste	Texture	Flavour	Overall acceptability
T ₁	8.26±0.65 ^d	8.20±0.93 ^d	8.06±0.91 ^c	8.17±0.77 ^b	8.17±0.70 ^d
T ₂	8.46±0.59 ^b	8.17±0.80 ^d	8.03±0.92 ^c	8.15±0.98 ^b	8.27±0.74 ^c
T ₃	8.31±0.58 ^c	8.41±0.70 ^b	8.32±0.72 ^b	8.43±0.67 ^a	8.57±0.49 ^b
T ₄	8.78±0.44 ^a	8.66±0.54 ^a	8.42±0.79 ^a	8.47±0.79 ^a	8.67±0.52 ^a

Values are expressed as mean±sd (n =3). The values in the same column with different superscript letters are significantly different (p < 0.05) as per Duncan's multiple comparison test.

Table 1 depicted that the experimental product T₄ got highest score in color (8.78±0.44), taste (8.66±0.54), texture (8.42±0.79), flavor (8.47±0.79), and overall acceptability (8.67±0.52) compared to other formulations. It may be due to the addition of 2 g of butterfly pea powder in the T₄ formulation. The sensory evaluation parameter values of experimental products were significantly different (p < 0.05) as per the Duncan's multiple comparison test. The results indicated that the T₄ product was superior in terms of all the organoleptic properties compared to rest of the formulations.

3.3 Proximate composition

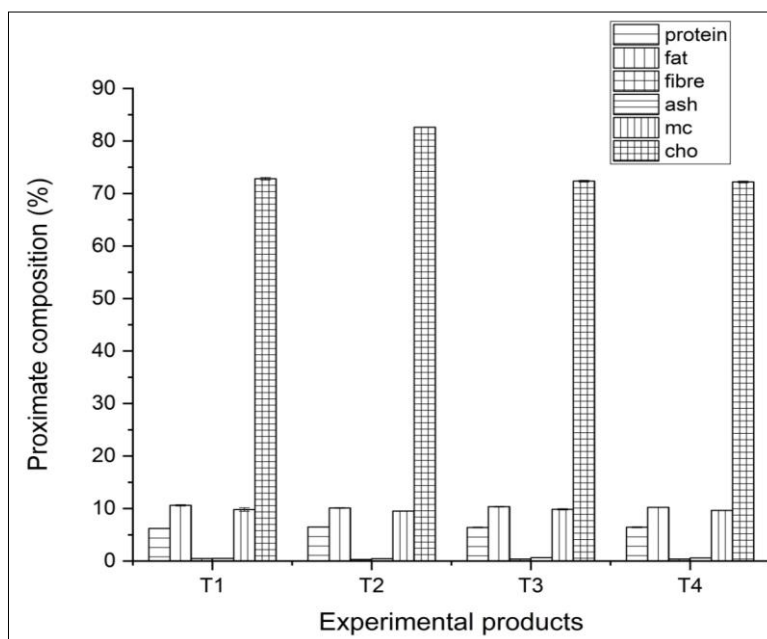


Fig 1: Proximate composition of experimental products

Table 3: Proximate composition of butterfly pea powder incorporated cookies

Sample name	Protein (%)	Fat (%)	Fibre (%)	Ash (%)	Moisture (%)	Carbohydrate*
T ₁	6.20±0.01	10.61±0.13	0.48±0.06	0.52±0.01	9.81±0.34	72.81±0.24
T ₂	6.48±0.04	10.11±0.08	0.31±0.00	0.46±0.02	9.51±0.05	82.62±0.04
T ₃	6.39±0.09	10.36±0.07	0.38±0.00	0.64±0.00	9.85±0.12	72.35±0.16
T ₄	6.43±0.10	10.23±0.02	0.37±0.00	0.58±0.05	9.64±0.00	72.20±0.17

Values are expressed as mean±sd

*Carbohydrate content was calculated based on the percent differential from 100%

Table 2 indicates that the highest protein content was observed in T₂ (6.48±0.04) and lowest in T₁, but the values were not significantly different (p < 0.05). The highest fat content was noted in T₃ (10.36±0.07), and lowest in T₂ (10.11±0.08). The fibre content was highest in T₁ (0.48±0.06) and lowest in T₂ (0.31±0.00). The highest ash content was observed in T₄ (0.58±0.05) and lowest in T₂ (0.46±0.02), the

moisture content of the experimental products ranged from 9.51% to 9.85%.

The carbohydrate content was varied from 82.62% to 72.20%. The proximate composition values were not varied much and all were nearest only. These values were more similar with the values of (Andresen *et al.*, 2013; Jeyaraj *et al.*, 2021) [3, 7].



Fig 1: Images of experimental products shown in figure

4. Conclusion

The current study was designed to prepare cookies with addition of butterfly pea powder and determined the best products via sensory evaluation and estimated their proximate composition.

- The experimental product T₄ got highest score in color (8.78 ± 0.44), taste (8.66 ± 0.54), texture (8.42 ± 0.79), flavor (8.47 ± 0.79), and overall acceptability (8.67 ± 0.52) compared to other formulations.
- It may be due to the addition of 2 g of butterfly pea powder in the T₄ formulation. The sensory evaluation parameter values of experimental products were significantly different ($p < 0.05$) as per the Duncan's multiple comparison test.
- The results indicated that the T₄ product was superior in terms of all the organoleptic properties compared to rest of the formulations.
- The highest protein content was observed in T₂ (6.48 ± 0.04) and lowest in T₁, but the values were not significantly different ($p < 0.05$). The highest fat content was noted in T₃ (10.36 ± 0.07), and lowest in T₂ (10.11 ± 0.08). The fibre content was highest in T₁ (0.48 ± 0.06) and lowest in T₂ (0.31 ± 0.00).
- The highest ash content was observed in T₄ (0.58 ± 0.05) and lowest in T₂ (0.46 ± 0.02), the moisture content of the experimental products ranged from 9.51% to 9.85%.
- The carbohydrate content was varied from 82.62% to 72.20%. The proximate composition values were not varied and much difference was not observed.

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