



## DEVELOPMENT AND QUALITY EVALUATION OF MUFFINS INCORPORATED WITH *BEDI DEL* (*Artocarpus nobilis*) SEED FLOUR

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### INTRODUCTION

*Artocarpus nobilis* is an evergreen plant species endemic to Sri Lanka. Its seeds and fruits are edible. It is found in the low-country up to 800 m altitude, however it is less common in the dry zone. Because of the wastage of seeds during the seasons, we can prepare flour from *Bedi Del* seeds to store them for a longer period of time. *Bedi Del* seed flour contains high nutritional value and it is a rich source of natural antioxidants. Recently most food industries are trying to develop new products that have high health benefits and quality. So, bakery products are in a higher position of value addition. Muffins are widely consumed in the world with their eating convenience, availability, different varieties and affordability. Therefore, underutilized *Bedi Del* seed flour can be used in value added bakery products such as muffins. The main objective of this study was to determine the physicochemical properties of *Bedi Del* seed flour and develop muffins incorporated with *Bedi Del* seed flour and rice flour.

### METHODOLOGY

#### Sample preparation

*Bedi Del* (*Artocarpus nobilis*) seeds were collected from the Biyagama area situated in Gampaha district, Sri Lanka. Initially, seeds were washed thoroughly to remove unwanted materials and white seed coats were removed. Then seeds with brown coats were dried in the sun and seeds were ground into fine particles by using a mechanical grinder. Next, the flour was sieved through 355 micron sieve and stored at room temperature (27 °C) approximately for four months in polypropylene bags till further analysis.

#### Proximate analysis of flour

The moisture and crude protein content was examined according to the dry oven method and Kjeldahl method respectively. Soluble protein content was carried out using the modified method by Bradford, (1976). Reducing sugar content was measured according to the Dubois method by Dubois, Gilles, Hamilton, Rebers, & Smith, (1951) with slight changes. Total ash content was determined according to the gravimetric method. Crude fiber content was measured according to the method by Islam, Begum, Khatun, & Dey, (2015) with small modifications.

#### Phytochemical composition of flour

Extraction was prepared by extracting with methanol. The dried flour sample was mixed with methanol in 1:40 (g/ml). This mixture was kept in a shaker at room temperature for 24 hours. Then the sample was centrifuged at 3000 rpm for 10 min and the supernatant was taken for analysis. Folin – Ciocalteu reagent assay was used to determine the total phenolic content of the flour according to the method by Vaher, Matso, Levandi, Helmja, & Kaljurand, (2010) with some modifications.

#### Functional properties of flour

The water holding capacity and oil holding capacity of flour were carried out using the method by Nwosu, Owuamanam, Omeire, & Eke, (2014)

#### Development of muffins incorporating *Bedi Del* seed flour



The recipe was developed after conducting preliminary trials. The control sample was prepared using only commercially available rice flour. From formula 1 to 3, *Bedi Del* seed flour content was increased and rice flour content was decreased.

Table 1: Formulation of muffins

Ingredients	Control (100 % rice flour)	Formula 1 (10% Bedi Del seed flour)	Formula 2 (20% Bedi Del seed flour)	Formula 3 (30% Bedi Del seed flour)
Rice flour	60 g	54 g	48 g	42 g
Bedi Del seed flour	0 g	6 g	12 g	18 g
Margarine	60 g	60 g	60 g	60 g
Sugar	60 g	60 g	60 g	60 g
Egg	50 g	50 g	50 g	50 g
Fresh milk	2 ml	2 ml	2 ml	2 ml
Vanilla	2 ml	2 ml	2 ml	2 ml
Baking powder	2 g	2 g	2 g	2 g

Initially, margarine and sugar were measured and beaten for 10 minutes using a spoon. Then egg and milk were added and beaten for another 5 minutes. After that, flour, baking powder and vanilla were added and mixed together. Then the mixture was poured into the mould containing paper cupcakes. Finally, it was baked in an oven at 180 °C for 20 minutes.

#### Sensory evaluation of muffins

Semi- trained 30 panellists were used to select the best muffin formulation. Each panellist was given three coded samples (B, C, D) with a ballot sheet and was asked to provide points according to their preferences for odour, colour, texture, taste and overall acceptability.

#### Proximate analysis of muffins

Same procedures were conducted to analyze the moisture, crude protein, soluble protein, total lipid, reducing sugar, total ash, crude fibre content of the control muffin sample and the best muffin sample selected from the sensory evaluation test.

#### Data analysis

All experiments were conducted in triplicate (dry weight basis) and expressed as the mean value  $\pm$  standard deviation. The 2-sample t test was carried out to compare the mean values of control and 20% *Bedi Del* added muffin. For the graphical representation of the data, Microsoft Office Excel 2013 software was used. Friedman non parametric analysis was used to analyze data for the sensory evaluation to determine any significant difference between selected samples at 95% confidence interval.

## RESULTS AND DISCUSSION

#### Proximate analysis of flour

The moisture content of the flour was  $4.47 \pm 0.11\%$ . If a sample contains low moisture content its shelf life is high. The protein value varies according to the value of the nitrogen to protein conversion factor used. In this study 6.25 conversion factor was used. The test for soluble protein content was conducted according to the Bradford method. It is a quick and sensitive method for quantitation of microgram quantities of protein. This method is developed by eliminating most of the problems involved in previously described methods by other scientists. The dye reagent exists in two colours, red and blue. The red colour is converted in to blue colour after binding of dye to protein. When increasing protein content of the sample, its colour is converted into blue colour. The reducing sugar content was determined using the Dubois method. When the sample treat with phenol and concentrated sulphuric, it gives orange yellow colour due to existence of simple sugars, oligosaccharides, polysaccharides and

their derivatives, including the methyl ethers with free or potentially free reducing groups (Dubois et al., 1951).

Table 2: Proximate analysis of *Bedi Del* seed flour

Parameter	Composition (%) - DW basis
Moisture	4.47±0.11
Crude protein	12.92±0.49
Soluble protein	1.48±0.23
Total lipid	16.23±1.05
Reducing sugar	13.79±1.02
Total ash	2.50±0.07
Crude fibre	1.47±0.05

### Phytochemical composition of flour

The total phenol content of *Bedi Del* seed flour was 70.08±0.66 mg Gallic acid equivalent per liter of flour extract. The data obtained in this study indicated that the total phenolic content is high in *Bedi Del* seed flour.

### Functional properties of flour

The water holding capacity and oil holding capacity of flour were 0.81±0.06 (g/g) and 0.89±0.06 (g/g) respectively. If water-holding capacity is high, it has a good ability to bind water. Protein and carbohydrate play a vital role in binding water. Oil holding capacity is a significant property because fats increase the flavor and mouthfeel of foods (Roy Chowdhury, Bhattacharyya, & Chattopadhyay, 2012).

### Development of muffins incorporating *Bedi Del* seed flour



Muffins were developed incorporating *Bedi Del* seed flour and rice flour with 3 ratios. Amount of other ingredients are the same for all.

A - Control (100 % rice flour)

B - 10% *Bedi Del* seed flour added muffin

C - 20% *Bedi Del* seed flour added muffin

D - 30% *Bedi Del* seed flour added muffin

Figure 1: Muffins incorporated with rice flour and *Bedi Del* seed flour

### Sensory evaluation of muffins



According to the radar diagram, C was ranked the highest average value for odour, taste and overall acceptability. Hence, C (20 % *Bedi Del* seed flour added muffin) was selected as the best experimental sample among three experimental samples for further analysis

Figure 2: Web diagram of the average rank of the three muffin samples (B - 10% *Bedi Del* seed flour added muffin, C - 20% *Bedi Del* seed flour added muffin, D - 30% *Bedi Del* seed flour added muffin) for sensory parameters

**Proximate analysis of muffins**

Table 3: Proximate analysis of muffins

Parameter (DW basis)	Control (100 % rice flour)	20 % <i>Bedi Del</i> seed flour added muffin
Moisture (%)	15.86±0.12 <sup>b</sup>	17.09±0.07 <sup>a</sup>
Crude protein (%)	4.85±0.49 <sup>a</sup>	6.80±1.03 <sup>a</sup>
Soluble protein (%)	2.85±0.11 <sup>a</sup>	2.38±0.05 <sup>b</sup>
Total lipid (%)	19.92±0.003 <sup>b</sup>	20.66±0.03 <sup>a</sup>
Reducing sugar (%)	21.34±0.12 <sup>a</sup>	20.32±0.28 <sup>b</sup>
Total ash (%)	2.83±0.05 <sup>a</sup>	2.91±0.03 <sup>a</sup>
Crude fiber (%)	0.67±0.04 <sup>b</sup>	1.24±0.06 <sup>a</sup>

(Different superscripts within the same row indicate significant difference (p < 0.05))

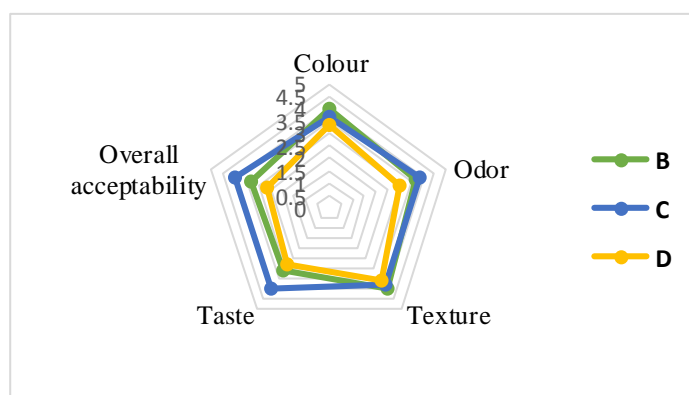
According to the proximate analysis, there was a significant difference between two muffin samples (control and 20% *Bedi Del* seed flour added muffin) at a 5% significance level for moisture, soluble protein, total lipid, reducing sugar and crude fiber content. Moisture, crude protein, total lipid, total ash and crude fiber content of 20% *Bedi Del* seed flour added muffin was higher than the control muffin.

**CONCLUSIONS/RECOMMENDATIONS**

Collectively, 20% of underutilized *Bedi Del* seed flour and 80% of rice flour can be utilized as a potential candidate to develop novel value-added muffins.

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