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### Development of muffin using *Musa acumina colla*, *Cucurbita moschata* and *Daucus carota L.*

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#### Abstract

Banana blossom, pumpkin seed and carrot are the easily available natural foods which are good source of dietary fiber, protein, antioxidant, omega-3 fatty acids vitamins and some minerals. Besides this they have various health benefits like anti-carcinogenic, anti-diabetic, and immune-enhancer benefits. Muffin is a popular convenient food. The present study was undertaken with an aim of developing muffins incorporating functional ingredients like banana blossom, pumpkin seed and carrot flour to assess its organoleptic evaluation and physical quality. Acceptability trials were conducted by a semi-trained panel consisting of 30 members in Department of Food, Nutrition and Dietetics of Assam downtown University against nine-point hedonic scale. Analysis of variance (ANOVA) in completely randomized design was done and the means were tested for significance at 5% probability level to find out whether product differs significantly from each other for all the quality attributes. Three formulations namely BM1, BM2 and BM3 were developed using different quantity of banana blossom keeping amount of other ingredients constant. Similarly, three formulations namely BM4, BM5 and BM6 were developed using different amount of pumpkin seeds keeping other ingredients at constant amount. Under each formulation six muffin product were developed and were subjected to acceptability trials. Out of six products BM5 (20% banana blossom+20% pumpkin seeds+5% carrot+55% refined flour) exhibited highest scores for sensory attributes. Moisture content analysis of acceptable product BM5 showed to have 40% of moisture.

**Keywords:** Acceptability trial, anti-oxidant, analysis of variance, banana blossom, convenient, immune enhancer

#### Introduction

Muffins are sweet baked food products. They have good taste and soft spongy texture. Baked products such as muffins, cake etc. have become most popular among all the age groups from childhood to adulthood worldwide because of their special characteristics and due to changing consumer's eating habits they require convenient food such as cake, muffins, biscuits etc. Among the processed foods, bakery products, particularly cakes command wide popularity among all the age groups. Muffins are high in carbohydrates, fat, calorie and low in fiber, vitamins and minerals which make them unhealthy for regular consumption but due to their acceptability in all age groups for better taste it is considered as a good product for fortification. Standard muffin batter is composed of sugar, fat or oil, flour, eggs, milk and baking powder (Baixauli R. *et al.*, 2007). The term muffins appeared in 1851 in a British magazine the 'London Laboure'. Muffins originally come from England. Apart from the delicious taste of muffins, their functionality can be worked out for therapeutic consumption for the patients suffering from different diseases by changing the type of fat used and incorporating functional ingredients while preparing the batter for muffins and cakes. A desirable muffin product has symmetrical shape, a golden-brown rounded top, creamy white or slightly yellow inside and free from streaks, uniform cell with moderate size, sweet flavor, pleasant aroma, moist and tender (McGuire B. *et al.*, 2001). Muffins come in wide range of size, shape and flavor. Muffins is a type of baked bread, which is sweeter than cupcakes without icing. It can be served during breakfast and mid-evening meal.

The ingredients chose for the development of the healthy nutritious muffins are Banana blossom (*Musa acuminata Colla*), pumpkin seeds (*Cucurbita moschata*), carrots (*Daucus carota L.*).

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The concept behind choosing Banana blossom is that they have high content of dietary fiber, low glycemic index and proteins, irons etc. It also acts as enzyme inhibitor. Further studies suggest that they are rich in antioxidants which making them ideal for cell health, metabolism and it shows to have antimicrobial property (Sumathi V. *et al.*, 2011). Banana blossom are very good source of potassium, phosphorus, magnesium, vitamin C, Vitamin A and vitamin B6 (Singh S. *et al.*, 2017) <sup>[80, 81]</sup>. In various regions of India people consume banana blossom as a curry with rice and wheat bread. It is also consumed as a boiled or deep-fried salad in Sri-Lanka. Various nutritious food products were developed incorporating banana blossom. Banana blossom is the outgrowth of banana cultivation. It was proved that banana blossom of various varieties is low in proteins. According to Bhaskar J.J. *et al.*, 2012 <sup>[13-15]</sup>, banana blossom contains abundant dietary fiber (5.74gm/100gm) which helps to maintain our body health to reduce cholesterol level and protect us from obesity. Banana flower enhance our immunity as it is rich in antioxidants like phenolic and flavonoids compounds (Loganayaki N. *et al.*, 2010) <sup>[48]</sup>. Researcher proved that it is useful for the treatment of bronchitis, dysentery, ulcer etc. (Kumar K.P.S. *et al.*, 2012) <sup>[42]</sup>. Sulaiman S.F. *et al.*, 2011) <sup>[86]</sup> stated that banana flower act as enzyme inhibitor from plant extract and an alternate approach to treat diabetes.

Pumpkin seeds are green small edible seeds of pumpkin plants which is flat in shape. It is a rich natural source of protein with the range of 25% to 37% and oil extracted from pumpkin seeds contains 37% to 45% protein (Milovanovic, M.M. *et al.*, 2008). Because of the good nutritional composition and health shielding values of pumpkin seeds pumpkin seeds have gained extensive attention in current times. Oil extracted from pumpkin seeds are considered very healthy loaded with Omega-3 fatty acids (Markovic, M. *et al.*, 1996), phytosterols (Phillips, KM. *et al.*, 2005); antioxidants, vitamins such as carotenoids and tocopherol (Stevenson, DG. *et al.*, 2017) <sup>[82-84]</sup> trace elements such as zinc (Glew, RH. *et al.*, 2006); iron and magnesium (Lim, TK. 2012). Pumpkin seeds are also a good source of dietary fiber with 31.48% crude fiber (Nyam, KL. *et al.*, 2013) <sup>[61]</sup>, and it is gluten free (Patel, S., 2013). It has many pharmacological properties so it is recommended for the protection of many diseases. Due to the beneficial phytochemical content of pumpkin seeds, they are used in salads, flakes, pastries as an additive (Xanthopoulou, MN. *et al.*, 2009) <sup>[96]</sup>. Seeds of pumpkins are rich source of iron with amino acids like tryptophan, lysine, methionine, tyrosine, therefore these seeds are beneficial for anemia patient (Adawy, El. *et al.*, 2001). Various studies found the important health benefits of pumpkin seeds in acute schistosomiasis (Patel, S. *et al.*, 2013), in the treatment of benign prostate hyperplasia, bladder stone disease (Caili, F. *et al.*, 2005), lower the chances of occurrence of many types of cancer (Huang, YS. *et al.*, 2003). Pumpkin seeds are prescribed for the protection against cutworm, tapeworm, seasickness and disturbance of pregnancy (Markovic, M. *et al.*, 1976). People consumed these seeds in fresh and roasted form for the relief of abdominal cramps and distension due to intestinal worms (Caili, F. *et al.*, 2005).

Carrots are popular root vegetables, rich in carotenoids and anthocyanins antioxidant. It was used for medical purposes firstly and gradually used as food. Carrots have a unique combination of three flavonoids: Kaempferol, quercetin and lutein (Poulin M.J. *et al.*, 1993). They have phenols, including chlorogenic caffeic and p-hydroxybenzoic acids

along with numerous cinnamic acid derivatives (Zhang D *et al.*, 2004) and some bioactive polyacetylenes such as falcarinol and falcarindiol. Carrots is a good source of dietary fiber and the trace mineral like molybdenum, manganese, magnesium etc. It acts as pro-vitamin A and pro-vitamin B (Guerrera, 2009). Carrot seems to have cancer fighting mechanisms. Researcher proved through their studies that carrots have antioxidant, anti-carcinogenic, immune-enhancer benefits, anti-diabetic, cholesterol and cardiovascular disease lowering and anti-hypertensive benefits. Molybdenum of carrots aids in metabolism of fats & carbohydrates. It is also important for absorption of fats. Magnesium content of carrots are needed for bone, carbohydrate-protein metabolism, for making new cells, activating B vitamins, relaxing nerves, muscles, clotting blood, energy production, and in insulin secretion and function. According to Patil, MVK. *et al.*, 2012 <sup>[65]</sup>, animals treated with topical cream of ethanolic extract of carrot root formulated at different concentration, showed significant decreases in wound area, epithelization period and scar width when compared to control group animals in an excision wound model.

The ingredients selected are enriched with high nutritive value, easily available and affordable; hence the research entitled "Development of muffins using *Musa acuminata colla*, *Cucurbita moschata* and *Daucus carota l.*" has been undertaken to incorporate a muffin with the following objectives:

- Development and formulation of muffins from composite flour using banana blossom, pumpkin seed and carrots.
- To carry out product acceptability through sensorics' attributes
- To carry out moisture content analysis of acceptable formulated muffins and control muffin.

### Materials and Methods

To carry out the research entitled Development of muffins using *Musa acuminata colla Cucurbita mochata* and *Daucus carota l.*, the selected ingredients i.e. banana flowers, pumpkin seeds, carrots and basic ingredients for cake were collected. Raw ingredients were processed to form flour. The composite flour were made into six different formulations in different ratios. The formulations were processed in a way to make a fine batter and baked. Further sensory analysis was done for different sensory attributes. The nutritional value was also recorded for accepted formulation and to check the shelf life, storage study was carried out. All the steps have been discussed briefly under following headings:

### Collection of samples

Fresh samples of Banana blossom, carrots and pumpkin seeds were collected from the local areas of Nalbari, Assam. Again, basic ingredients required for muffins were collected from local market of Guwahati, Assam.

### Processing of raw materials for product development

The preparation of dried banana blossom, pumpkin seeds and carrots powder for product development includes washing, drying, grinding and packaging. In case of banana blossom two to three layers were sorted out and washed with clean water thoroughly to remove all the dirt. The washed banana blossoms were cut on small round pieces and oven dried for two days. The dried pieces were ground into fine powder using electric blender and kept in air tight container to keep away from direct sunlight to avoid chemical reaction.

Similarly, carrots collected for carrying out the study, were

washed with clean water. After that upper layer of carrots were sorted out and sliced into small round pieces. The pieces were spread on a tray and oven dried for three days. The dried pieces were ground in to fine powder with the help of electronic blender and kept in air tight container.

Again, in case of pumpkin seeds, shells were sorted out. The greenish seeds were fried in an induction stove for 5mins and ground into fine powder using electronic blender. Powdered sample were stored in an air tight container for further processing.

### Sample identification

Sample identification BM1, BM2, BM3, BM4, BM5 were the codes given for identification of products prepared from dried banana blossom, pumpkin seed and carrot powder in various formulations.

### Formulation of muffins by using dried *Musa acuminata*

**Table 1:** Formulations of banana blossom muffins using banana blossom

| Formulation | Banana blossom powder (gms) | Pumpkin seeds powder (gms) | Carrots powder (gms) | Refined wheat flour (gms) |
|-------------|-----------------------------|----------------------------|----------------------|---------------------------|
| BM1         | 35                          | 10                         | 5                    | 50                        |
| BM2         | 30                          | 10                         | 5                    | 55                        |
| BM3         | 25                          | 10                         | 5                    | 60                        |

BM- Banana blossom muffin

### Formulation of pumpkin seed muffins

Pumpkin seed muffins were developed by using rich amount of pumpkin seed powder in comparison to carrot and banana

### *cola, Cucurbita moschata and Daucus carota L powder*

The ingredients were mixed in to six different formulation in different proportion. Firstly, powdered sugar was beat with eggs to attain a creamy consistency using an electronic beater. After that composite flour was added to the mixer thoroughly with the electronic beater. Then addition of milk and oil takes place and the batter was mixed thoroughly. The mixture was kept on muffin trays and put in to the preheated oven (180 °C for 5 mins) at 180 °C temperature for 15 minutes for baking. The proportions of each ingredients were different as following in the given table. A control muffin recipe was adapted from a standard muffin recipe (Hanna A *et al.* 2005).

### Formulation of banana blossom muffins

Banana blossom Muffin were developed using dominant amount of banana blossom flour. The details of product formulations were given in the following table 4

blossom powder. The details of formulations were given to the following table 5

**Table 2:** Formulation of banana blossom muffins using pumpkin seeds

| Formulation | Banana blossom (gms) | Pumpkin seed (gms) | Carrots (gms) | Refined-wheat flour (gms) |
|-------------|----------------------|--------------------|---------------|---------------------------|
| BM4         | 20                   | 25                 | 5             | 50                        |
| BM5         | 20                   | 20                 | 5             | 55                        |
| BM6         | 20                   | 15                 | 5             | 60                        |

**Table 3:** Additional ingredients used in both types of muffin making

| Formulation | Additional ingredients (g/100g) |     |      |          |               |               |      |
|-------------|---------------------------------|-----|------|----------|---------------|---------------|------|
|             | Sugar                           | Oil | Milk | Cardamom | Egg           | Baking powder | Salt |
| BM1         | 51                              | 21  | 75   | 1        | 2 no. (26 ml) | 4.3           | 2.1  |
| BM2         | 51                              | 21  | 75   | 1        | 2 no. (26 ml) | 4.3           | 2.1  |
| BM3         | 51                              | 21  | 75   | 1        | 2 no. (26 ml) | 4.3           | 2.1  |
| BM4         | 51                              | 21  | 75   | 1        | 2 no. (26 ml) | 4.3           | 2.1  |
| BM5         | 51                              | 21  | 75   | 1        | 2 no. (26 ml) | 4.3           | 2.1  |
| BM6         | 51                              | 21  | 75   | 1        | 2 no. (26 ml) | 4.3           | 2.1  |

### Sensory evaluation of formulated muffins

The acceptability trial was done including 30 semi trained panelists in the laboratory of Food Nutrition and Dietetics using 9-point Hedonic scale. The panelists evaluated the samples on the basis of colour, appearance, taste, texture, flavor and overall acceptability.

### Packaging materials

Packaging is the technology of enclosing or protecting products for distribution, storage, scale, and use. The muffins were kept in twelve plastic bottles for product development. The bottles and containers were washed and kept for dry. After drying the muffins were stored in each plastic containers and sealing process took place after the container has been filled and capped. The bottles were kept in room temperature (26 °C) for further evaluation.

### Moisture content analysis

The moisture content was determined by oven drying method

using standard AOAC (1975) procedure. Five grams of samples was weight into a previously weight moisture cup and dried in an oven at 60 °C till a constant weight was attained.

$$\text{Moisture (\%)} = \frac{\text{Initial weight (g)} - \text{final weight (g)}}{\text{sample weight (g)}}$$

### Shelf life (storage) of the developed product

Shelf life or storage study was done to assess the overall hygiene maintained during the process of preparation of muffins. For that sensory evaluation and microbial study were done. The shelf life of muffins is extremely important. The developed muffins were stored in plastic containers for 15 days and its quality parameters i.e. colour, appearance, etc. were studied. The muffins were stored at room temperature (26 °C).

### Determination of colony (microbes) present in developed products

This method for estimating microorganism was modified by Tate (1995), though various methods were available to isolate and enumerate microorganisms (bacteria, fungi, actinomycetes, protozoa, algae, virus and mycoplasma) from soil, food stuffs, milk and water. The serial dilution agar plating method or viable plate count method is one of the commonly used procedures for the isolation and enumeration of fungi, bacteria and actinomycetes which are most prevalent microorganisms. This method is based upon the principle that material containing microorganisms appearing on the plates represent the number of living organisms present in the sample. The number of colonies appearing on dilution plates are counted, averaged and multiplied by the dilution factor to

find the number of cells/pores per gram (or milligram) of sample:

$$\text{No. of cells/ml or g} = \frac{\text{No. of colonies} \times \text{Dilution factor}}{\text{Dry weight of muffin sample}}$$

Dilution factor = Reciprocal of the dilution

### Results and Discussion

#### Organoleptic evaluation for sensory attributes

Organoleptic evaluations for the samples were carried out for the parameters colour, taste, texture, consistency, flavor and overall acceptability.

**Table 4:** Mean acceptability scores of *Musa acuminata colla*, *Cucurbita moschata* and *Daucus carota* L. incorporated muffins

| Product  | Formulations | Quality Attributes |            |           |           |           |                       |
|--|--------------|--------------------|------------|-----------|-----------|-----------|-----------------------|
|  |              | Colour             | Appearance | Taste     | Texture   | Flavor    | Overall acceptability |
| <i>Musa acuminata colla</i> , <i>Cucurbita moschata</i> and <i>Daucus carota</i> L. incorporated muffins | BM1          | 7.33±1.37          | 7.23±1.37  | 7.33±1.29 | 7.06±1.31 | 7.6±1.16  | 7.30±0.75             |
|  | BM2          | 7.0±1.30           | 6.96±1.03  | 7.56±1.25 | 7.46±1.19 | 7.75±0.93 | 7.20±0.71             |
|  | BM3          | 6.83±1.41          | 6.96±1.18  | 7.36±1.47 | 7.13±1.35 | 7.63±0.96 | 7.00±0.90             |
|  | BM4          | 6.83±1.01          | 6.60±1.03  | 7.30±0.98 | 7.3±0.83  | 7.76±0.89 | 7.10±0.80             |
|  | BM5          | 7.63±1.03          | 7.60±0.96  | 8.67±0.54 | 8.16±0.64 | 8.20±0.80 | 8.13±0.68             |
|  | BM6          | 7.20±1.03          | 6.73±0.94  | 7.76±0.77 | 7.6±0.93  | 7.96±0.74 | 7.33±0.60             |

### Discussion

All the sensory attributes i.e. colour, appearance, taste, texture, flavor and overall acceptability are higher for BM5 formulation out of the six muffins formulations. BM5 exhibited the highest score for all the sensory attributes in terms of colour (7.63), appearance (7.60), taste (8.67), texture (8.16) flavor (8.20) and overall acceptability (8.13). The balance amount of banana blossom and pumpkin seeds gave a perfect desirability for the product and accepted by maximum panelists.

All the sensory attributes are lower for BM3.

#### Moisture analysis of formulated muffins

Moisture content of the control muffin and highly acceptable banana blossom muffin, pumpkin seed and carrot enriched muffin (BM5) were determined in present study. It was observed that banana blossom muffin (BM5) got higher moisture content percentage i.e. 40.4% than control muffin (32%).

**Table 5:** Moisture content of control and banana blossom, pumpkin seed, carrot enriched muffins

| Moisture content (%) | Control muffin | Banana blossom muffin (BM5) |
|----------------------|----------------|-----------------------------|
|                      | 32%            | 40.4%                       |

### Shelf life storage and microbial count studies of the developed muffins

Commercial bakery products are known for their better shelf life. In this study developed enriched banana blossom, pumpkin seed and carrot enriched muffins were packed in plastic air tight containers were evaluated for storage stability in comparison to control muffin.

During storage organoleptic characteristics changes were observed in developed muffins at regular intervals of time by organoleptic evaluation. From the table 4.6 it was found that after 7<sup>th</sup> day of storage period significant changes were

observed and fungus growth was observed on 10<sup>th</sup> day. The organoleptic characteristics changes were drastically declined after 5<sup>th</sup> day of storage which may due to stickiness on the top of the muffin and also may due to growth of fungus. The growth of fungus in developed banana blossom, pumpkin seed, carrot enriched muffins may due to higher nutrient composition which is favorable for the growth of microorganisms. Muffins prepared with refined wheat flour alone was acceptable up to 5<sup>th</sup> day of storage but developed banana blossom muffins (BM) were acceptable up to 7<sup>th</sup> day of storage period.

**Table 6:** Microbiological quality (C.F.U/gm) of food sample

| Product | Quality attributes changes during 0-7 days |           |            |          |         |           |          |           |         |          |                       |         |
|---------|--|-----------|------------|----------|---------|-----------|----------|-----------|---------|----------|-----------------------|---------|
|         | Colour                                     |           | Appearance |          | Taste   |           | Texture  |           | Flavour |          | Overall acceptability |         |
|         | 0 day                                      | 7 days    | 0 day      | 7 days   | 0 day   | 7 days    | 0 day    | 7 days    | 0 day   | 7 days   | 0 day                 | 7 days  |
| BM1     | 7.3±1.3                                    | 5.5±0.81  | 7.2±1.1    | 5.6±0.81 | 7.3±1.2 | 5.16±0.71 | 7.0±1.3  | 433±0.81  | 7.6±1.1 | 4.5±0.54 | 7.3±0.7               | 4.8±0.4 |
| BM2     | 7±1.3                                      | 4.6±0.51  | 6.9±1.0    | 5.5±0.54 | 7.5±1.2 | 5.16±0.75 | 7.4±1.1  | 4.67±0.51 | 7.7±0.9 | 4.3±0.51 | 7.2±0.7               | 4.8±0.4 |
| BM3     | 6.8±1.4                                    | 4.5±0.54  | 6.9±1.0    | 5.3±0.51 | 7.3±1.4 | 5.33±0.51 | 7.1±1.3  | 4.5±0.83  | 7.6±0.9 | 4.5±0.4  | 7±0.9                 | 5±0.6   |
| BM4     | 6.8±1.0                                    | 4.5±0.54  | 6.6±1.0    | 5.3±0.51 | 7.3±0.9 | 5.33±0.81 | 7.3±0.8  | 4.33±0.51 | 7.7±0.8 | 5.1±0.9  | 7.1±0.8               | 4.8±0.4 |
| BM5     | 7.6±1.0                                    | 5.83±0.75 | 7.6±0.9    | 6.1±0.98 | 8.6±0.5 | 5.66±1.21 | 8.1±0.6  | 4.83±0.75 | 8.2±0.8 | 4.5±0.5  | 8.1±0.6               | 6.1±0.6 |
| BM6     | 7.2±1.0                                    | 4.83±0.4  | 6.7±0.9    | 5.5±0.54 | 7.7±0.7 | 4.8±1.16  | 7.6±0.93 | 4.1±0.75  | 7.9±0.1 | 4.3±0.5  | 7.3±0.6               | 4.8±0.4 |

**Table 7:** Sensory evaluation over storage

| Product code | Total viable count in 10 days |
|--------------|-------------------------------|
| Control      | 10                            |
| BM5          | 5                             |

The total plate count (TPC) of the stored muffin was analyzed after storage for 10 days. There were 5 numbers of colonies

found in the banana blossom, pumpkin seed and carrot enriched muffin (BM5). Again, for the control muffin there were 10 numbers of colonies observed after storage for 10 days.

### Nutritive value of the raw ingredients of formulated muffin product

**Table 8:** Nutritive value of BM5

| Name of the ingredients     | Nutritive value (in grams) |        |             |               |        |         |            |         |
|-----------------------------|----------------------------|--------|-------------|---------------|--------|---------|------------|---------|
|                             | Protein                    | Fat    | Crude fiber | Carbohydrates | Energy | Calcium | Phosphorus | Iron    |
| Banana blossom (20 gm)      | 0.32                       | 0.12   | 1.14        | 1.98          | 10.2   | 11.2    | 14.66      | 11.28   |
| Pumpkin seeds (20)          | 9.8                        | 9.4    | 2.16        | 2.8           | 138    | 20      | 320        | 4       |
| Carrot (5 gm)               | 0.045                      | 0.01   | 0.055       | 0.53          | 2.4    | 4       | 26.5       | 0.05    |
| Refined wheat flour (55 gm) | 6.05                       | 0.495  | 0.165       | 40.645        | 191.4  | 12.65   | 66.55      | 1.485   |
| Refined oil                 | -                          | 20     | -           | -             | 180    | -       | -          | -       |
| Egg                         | 15.96                      | 15.96  | -           | -             | 207.6  | 72      | 264        | 2.36    |
| Sugar                       | 0.05                       | -      | -           | 49.7          | 199    | 6.12    | 112.2      | 0.0775  |
| Cardamom                    | 0.102                      | 0.022  | 0.201       | 0.421         | 2.29   | 1.3     | 1.6        | 0.046   |
| Salt                        | -                          | -      | -           | -             | -      | -       | -          | -       |
| Milk                        | 2.4                        | 3.075  | -           | 3.3           | 50.25  | -       | -          | 0.15    |
| Baking powder               | -                          | -      | 0.01        | 1.4           | 2.65   | -       | -          | 0.55    |
| Total                       | 34.727                     | 49.082 | 3.731       | 100.776       | 983.79 | 127.27  | 805.51     | 19.9985 |

The results of nutritional composition like moisture, protein, fat, carbohydrate, crude fiber, energy and minerals like calcium, phosphorus and iron of muffins are discussed in the above table.

### Discussion

The nutritive value of the muffin incorporated with banana blossom, pumpkin seed and carrot flour was calculated. All the formulation showed to have a good nutrient composition with higher values of carbohydrate, protein and energy, dietary fiber. As the ingredient are rich in vitamins and minerals, muffins may contain some amounts of vitamins and minerals.

### Conclusion

From the present study it can be concluded that the muffins formulated showed to have good acceptability score and has a potential of having many health benefits. It was found that muffins incorporated with banana blossom, pumpkin seed and carrots with 20 gm of banana blossom, 20 gm of pumpkin seed, 5gm of carrot powder and 55gm of refined wheat flour got higher acceptability score. The shelf life of the Muffins when stored in an airtight container or properly sealed packaging materials has the capability to be stored for more than 7 days at room temperature and 15-20 days at refrigerator temperature. They retained its original properties of appearance, flavor, color and aroma and no signs of spoilage by mould or fungus were observed in the samples stored in HDPE containers till 7 days at room temperature.

The formulated muffins with rich nutrient composition ingredients like banana blossom, pumpkin seed and carrot not only enhanced the sensory properties of muffins alone but also enhanced the nutritional composition. As muffins is a popular convenient food product among all age groups, the muffins incorporated with banana blossom, pumpkin seed and carrot may fulfill the requirement of nutritional needs.

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### Conflicts of Interest

The author declares no conflict of interest.

### Disclaimer statement

This work is a part of a thesis submitted to Assam downtown University for award of Masters degree for the thesis entitled "Development of muffins using *Musa acuminata colla*, *Cucurbita mochata* and *Daucus carota l*," Department of Food Nutrition and Dietetics, under the supervision of Mr. Birinchi Bora, Assistant Professor, Department of Food Nutrition and Dietetics, Assam Downtown University.

### Authorship and level of contribution

MS performed and wrote the research paper. DS analyzed and guided through the whole process.

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