Development and quality characteristics of muffins from dried Smilax perfoliata leaf powder

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ABSTRACT: *Smilax perfoliata* is a woody climbing plant and widely used in traditional cuisine by many tribes of North-east India. The main objectives of the study were to developed muffins from dried *Smilax perfoliata* leaf powder and to check its acceptability, shelf life, moisture content and the microbial count of the accepted formulated muffin with its constituent ingredients. For the development of muffins the ingredients were made into five different formulations in different proportions. For evaluating the acceptability of the developed formulations, score card method was selected. The qualities taken into consideration were colour, appearance, taste, texture, flavor and overall acceptability of food products. The muffins were kept in six plastic bottles for 10-20 days for product development at room temperature. The moisture content was determined by oven drying method using standard AOAC (1975) procedure. Microbial count of the developed muffins was determined by the serial dilution agar plating method. During the acceptability trials it was found that among the five developed products M5 was selected who got the highest scores. It was observed that *Smilax perfoliata* incorporated muffin (M5) got higher moisture content percentage i.e. 33.2% than control muffin i.e. 32%. After the shelf life study it was seen that muffins prepared with refined wheat flour alone were acceptable up to 10th day of storage but developed *Smilax perfoliata* incorporated muffins were acceptable up to 15th day of storage period. The microbiological count of the selected product revealed that there were 5 microbial colonies found in M5 during 15 days of storage. The microbiological quality of the muffins was good up to 15 days of storage. Nutritive value of the selected formulations was calculated and all the formulations had high nutritive value. The formulated muffin has high energy value i.e. 1013.37 kcal and high carbohydrate value i.e. 131.89 gram and high fat value i.e. 39.99 gram. It is concluded that the present study of the development of muffins by using dried *Smilax perfoliata* leaf powder formulated showed to have high nutritive value, antimicrobial activity and has a potential of having many health benefits. Hence the results of the present research can be used as valuable information for development of muffin by using dried *Smilax perfoliata* leaf powder.

Keywords: *Smilax perfoliata*, muffins, formulations, sensory evaluation, hedonic scale, panel.

INTRODUCTION

Medicinal plants are abundantly found in North-east India. Some of these are used not just for the treatment of specific diseases, but also for maintaining general health. There are several reports of such traditional medicinal uses of plants, phytochemical screening and estimation of total phenol and flavonoid contents. These types of plants have attracted much attention of researchers for their potential antioxidant activities (Sharma H.K. *et al.*, 2014).

The *Smilax* (Family- Smilacaceae) genus consists of about 300-350 species and can be found in the temperate zones, tropics and sub-tropical regions of the world. By nature, they are climbing flowering plants (Mohammed R. *et al.*, 2012). *Smilax perfoliata* is a woody climbing plant and widely used in traditional cuisine by many tribes of North-east India (Borkataky M., 2014). It is also used in treatment of abscesses, skin disorder, sores, swellings, frequent urination, diabetes, venereal disease and to evaluate antiepileptic activity (Reddy P. *et al.*, 2013). Stem is used as toothbrush to strengthen the gums. Tender shoot is taken in curries and is useful as blood purifier. Roots and stem are used as anticancer, anti-dysenteric and urinary complaints.
Muffins are sweet, high-calorie baked products which are highly appreciated by consumers due to their good taste and soft texture. During the past few years’ number of researchers conducted experiments to improve the nutritional value of muffins like fiber rich muffins, sugar free muffins, antioxidant rich muffins and fat free muffins (Nidoni U., 2015). 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 etc. Standard muffin batter is composed of sugar, fat or oil, flour, eggs, milk and baking powder (Baixauli R. et al., 2007). 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.

The physico-chemical properties of the Smilax perfoliata incorporated muffin were measured and conclusions associated with Smilax perfoliata powder supplementation were drawn.

**JUSTIFICATION:** The Smilax perfoliata leaf powder chooses for the development of the healthy nutritious muffins. Further studies reveals that the S. perfoliata rich in antioxidants which making them ideal for cell growth, metabolism and anti-aging. They have also antihyperglycemic effect and rich in micro nutrients. Muffins are highly consumed by variety of people. So, the development of muffin with the incorporation of Smilax perfoliata leaf powder will be carried out the study.

**OBJECTIVES:** This project work has been undertaken with respect to fulfill the following objectives-

1. To develop and formulate muffins from dried Smilax perfoliata leaf powder.
2. To carry out moisture content analysis of formulated muffins.
3. To study the shelf life of develop muffin.

**MATERIALS AND METHODOLOGY**

This chapter includes the materials used for the investigation and enumerates the processing steps and methodologies followed to evaluate the sensory qualities of the product made in the food nutrition and dietetics laboratory and microbiological analysis made in microbiology department. The experimental procedure followed to pursue the research pertaining to this present study on “Development and quality characteristics of muffins from dried Smilax perfoliata leaf powder” are detailed in this chapter under the following heads-

3.1 Collection of samples
3.2 Processing of raw materials for product development
3.3 Sample identification
3.4 Formulation of muffins by using dried Smilax perfoliata leaf powder
3.5 Sensory evaluation of formulated muffin
   3.5.1 Formulation of score card
   3.5.2 Selection of panel
   3.5.3 Acceptability trials
3.6 Packaging materials
3.7 Moisture content analysis
3.8 Shelf life (storage) of the developed product
   3.8.1 Sensory evaluation across storage
   3.8.2 Determination of colony (microbes) present in develop products
3.9 Statistical analysis

3.1 Collection of samples

For carrying out the present study the required Smilax perfoliata leaves were collected from the Bokota, village of Sivasagar district and the other required samples were collected from the local markets of Guwahati.

3.2 Processing of raw materials for product development

The preparation of dried Smilax perfoliata leaf powder for product development includes washing, drying, grinding and packaging. Fresh, undamaged leaves were sorted and washed with clean water thoroughly to remove all the dirt. The washed leaves were shade dried for 15 days. The dried leaves were ground into fine powder using electric blender and kept in air tight container to keep away from direct sunlight to avoid chemical reaction.

3.3 Sample identification

Sample identification M1, M2, M3, M4, M5 was the codes given for identification of products prepared from dried Smilax perfoliata leaf powder in various formulations.

3.4 Formulation of muffins by using dried Smilax perfoliata leaf powder

For the development of muffins the ingredients were made into five different formulations in different proportions and mixed thoroughly. First beat the powdered sugar with eggs to attain a creamy consistency and after that add dried Smilax perfoliata leaf powder, refined flour, and baking powder thoroughly and beat it about 5-10 minutes. Then addition of milk and oil takes place and mix the batter thoroughly. Then the mixture was kept on muffin trays in the oven at 180° C temperature for 15 minutes for baking. The prepared muffins were stored in the plastic air tight containers in the room temperature after sealing. The proportions of each ingredient are following in the given table. A control muffin formula was adapted from a standard muffin recipe (Hanna A et al.2005).

Table-1 Formulations of muffins by using dried Smilax perfoliata leaf powder

<table>
<thead>
<tr>
<th>FORMULATIONS</th>
<th>INGREDIENTS (g)</th>
<th>ADDITIONAL INGREDIENTS (g/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Refined flour</td>
<td>Smilax perfoliata powder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sugar</td>
</tr>
<tr>
<td></td>
<td></td>
<td>oil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>milk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>egg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>baking powder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>salt</td>
</tr>
<tr>
<td>M1</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>M2</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>M3</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>M4</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>M5</td>
<td>80</td>
<td>20</td>
</tr>
</tbody>
</table>
Flowchart for the preparation of *S. perfoliata* incorporated muffins are given below-

1. Beating egg + sugar
2. Shifting refined flour + baking powder + salt + dried *S. perfoliata* powder
3. Addition of milk, oil and mixing the batter thoroughly
4. Transferring in muffin trays
5. Baking at 180°C for 15 minutes in oven
6. Cooling and stored in air tight plastic container
7. Sealing and labeling
8. Storage at room temperature

Fig 1: Flowchart for making *S. perfoliata* leaf powder incorporated muffins

### 3.5 Sensory evaluation of formulated muffins

Sensory evaluation is a dynamic field concentrating on the utilization of human for measurement of sensory perception and/or their effect on food and taste acceptance (Sidel and stone, 2004).

The acceptability trial was done in the Food science Laboratory of the Department of Food, Nutrition and dietetics in the following manner:

#### 3.5.1. Formulation of score card

For evaluating the acceptability of the developed formulations, score card method was selected. According to Pigot and Hunter (1999) scoring is a form of rating using numerical score where the numbers from an interval or the ratio scale. In the present study a score card was made consisting a table utilizing the hedonic ratings of nine point scale (Peryam and Pilgrim, 1957) from like extremely to dislike extremely. The qualities taken into consideration were colour, appearance, taste, texture, flavor and overall acceptability of food products where one to six samples are served to the panelists at one session and asked to rate the product. The 9-point Hedonic scale is shown in Annexure 1.

#### 3.5.2 Selection of panel

According to Pigot and Hunter (1999) a panel is a group of assessors chosen to participate in a sensory test. Sensory evaluation was conducted by a semi trained panel consisting of 30 members. These panelists were willing to cooperate and gave time for judging and were able to discriminate the taste.

#### 3.5.3 Conduction of acceptability trials

Acceptability trials were conducted by a semi trained panel consisting of thirty numbers from the department of Food, nutrition and dietetics. Scoring was done by using nine point hedonic scales. The muffins were standardized for sensory characteristics. For the sensory evaluation of muffins six formulations were developed. The product were carefully prepared to have the correct taste, flavor, texture and were carefully presented simultaneously at room temperature along with the score cards. The sessions for testing were held in a well ventilated laboratory. The judges were in good health at a time of evaluation. The judges were allowed to be seated on the chairs at the corner
of the laboratory. The samples were served in identical plates and the proportions of samples were adequate for tasting. Glasses of water were provided for rinsing the mouth. At the beginning of each testing sessions, the descriptive term for each quality to be evaluated were explained to the panel members. The panel members evaluated the samples on the basis of colour, appearance, taste, texture, flavor and overall acceptability. The scores for each quality were total averaged.

3.6 Packaging materials
Packaging is the technology of enclosing or protecting products for distribution, storage, scale, and use. The muffins were kept in six plastic bottles for product development. The bottles and containers were washed and kept 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.

3.7 Moisture content analysis
The moisture content was determined by oven drying method using standard AOAC (1975) procedure. Two 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.

\[
\text{Moisture} = \frac{\text{Initial weight}}{\text{final weight} - \text{sample weight}} \times 100
\]

3.8 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 which are discussed in detail below.

3.8.1 Sensory evaluation across storage
The shelf life of muffins is extremely important. The developed muffins were stored in plastic containers for 10-20 days and its quality parameters i.e. colour, appearance, etc. were studied. The muffins were stored at room temperature (26°C).

3.8.2 Determination of colony (microbes) present in developed products
This method for estimating microorganisms 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:

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

Dilution factor= Reciprocal of the dilution
Procedure

1. Collect muffin samples at random, minimum five, mix thoroughly to make a composite sample for microbiological analysis.
2. Label 90 ml sterile water blanks as 1, 2, 3, 4, 5, 6, and 7 and sterile petri dishes as 10 (3 plates), 10(6), 10(9), 10(6) and 10(3) with a wax pencil.
3. Add 1g sample of finely pulverized, and add numbered 1 water blank to make 1: 10 dilution(10)
4. Vigorously shake the dilution on a magnetic shaker for 20-30 minutes to obtain uniform suspension of microorganism
5. Transfer 1 ml of suspension from flask number 1 into water blank numbered 2 with a sterile pipette under aseptic conditions to make 1:100(10) dilutions and shakes it well for about 5 minutes.
6. Prepare another dilution 1:1000(10) by using pipetting 1ml of the suspension into water blank numbered 3, using a fresh sterile pipette and shake it.
7. Make further dilutions 10 to 10 by pipetting 1 ml suspension into additional water blanks (4, 5, 6, and 7) as prepare above.
8. Transfer 1 ml aliquots each from 10 dilutions blank into 3 sterile petri dishes, from 10 dilutions blank to 6 sterile petri dishes, from 10 to 3 petri dishes.
9. Add approximately 15ml of the cooled medium (45°C) to each petri dish and mix the inoculums by gentle rotation of the petri dishes. The three media are to be added to various dilutions as follows-
   For bacteria= nutrient agar medium to 12 plated with 10 dilutions
10. Upon solidification of the media, incubate all the plates in an inverted position at 25°C for 2-7 days

Result:

Calculate the number of organisms (bacteria, actinomycetes and fungi) per gram of the muffin sample by applying the formula:

\[
\frac{\text{Mean plate count \times Dilution factor}}{\text{Dry weight of muffin sample}}
\]

3.9 Statistical analysis

To assess whether the relationship observed between the formulations characteristics and sensory response, were likely to be real and not merely the result of uncontrolled variation in response, the methods of statistics were present the same in table etc.

All the data of the chemical analysis were statistically analyzed (Chandel, 2000) and methods applied for the statistical analysis of the recorded data are given below:

1. Mean: it is the sum of all the observation (\(\sum x_i\)) divided by the number of observation (N). the formula of calculating mean (x) is given below-

\[
\bar{x} = \frac{\sum x_i}{N}
\]

Where,

\(\bar{x}\) – Mean
\(\sum x_i\) – Sum of all observations
N – Number of observations

2. Standard deviation: Standard deviation is the positive square root of the arithmetic mean of the square of deviations of the given values from arithmetic mean. If the standard deviation of a sample were smaller than a population, then it is measured by using the following formula:
Standard deviation ($\sigma$) = $\sqrt{\frac{\sum (x_i - \bar{x})^2}{N}}$

Where,

$x_i$ - Number of observations

$\bar{x}$ - Arithmetic mean

$N$ – Number of observations.

RESULT AND DISCUSSION

The result of the study on “Development and quality characteristics of muffins from dried *Smilax perfoliata* leaf powder” are presented under the following heads

4.1 Collection of sample

4.2 Formulation and standardization of muffins

4.3 Acceptability trials of the formulated muffins

4.4 Sensory evaluation of the formulated muffins

4.5 Moisture content analysis of the formulated muffins

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

4.7 Microbiological quality of the developed muffins.

4.8 Nutritive value of raw ingredients used for making muffins

4.1 Collection of sample

A preliminary survey was carried out in local people of Bokota, Sivasagar district. Several information was collected like habitat, uses, local name etc. by interviewing face to face with the villagers. So, in the present study the plant *Smilax perfoliata* was selected because there was not any food product development from this plant. So, it was decided to select this plant to develop nutritious muffins.

4.2 Formulation and standardization of muffins

*Smilax perfoliata* was used to develop muffins by following methods of formulations to enhance the quality, taste and flavor. There are five different formulations were done in the laboratory of Department of Food, Nutrition and Dietetics.

4.3 Acceptability trials of the formulated muffins

Acceptability of a product is determined by sensory evaluation. The enjoyment of products is closely related to senses sand in the case of food it is mainly taste, aroma and texture. Sensory evaluation is a dynamic field concentrating on the utilization of humans for the measurement of sensory perception and/or their effects on food and taste acceptance (Stone and Side, 1993), sensory analysis is a scientific discipline requires made by them. Since there is no one instrument that can replicate or replace the human physiological and emotional response, the sensory evaluation component of any food study is very essential (Lawless and Klein, 1989). Acceptability trials were conducted by a panel of semi trained judges consisting of thirty numbers of students from the Department of Food, Nutrition and Dietetics. Scoring was done by using 9-point hedonic scale. All the panelists were not in a habit of Chewing tobacco, smoking etc.
Table 2: Mean acceptability scores of *S. perfoliata* incorporated muffins

<table>
<thead>
<tr>
<th>Product</th>
<th>Formulations</th>
<th>Quality Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Colour</td>
</tr>
<tr>
<td><em>Smilax perfoliata</em> incorporated</td>
<td>M1</td>
<td>5.1±0.75</td>
</tr>
<tr>
<td>muffins</td>
<td>M2</td>
<td>5.03±0.85</td>
</tr>
<tr>
<td></td>
<td>M3</td>
<td>5.9±0.92</td>
</tr>
<tr>
<td></td>
<td>M4</td>
<td>7.8±0.97</td>
</tr>
<tr>
<td></td>
<td>M5</td>
<td>8.1±0.94</td>
</tr>
</tbody>
</table>

From the table 2 it can be seen that while considering the mean colour score of the five formulations M5 got the highest score i.e. 8.1 and M1 got the lowest score. This might because due to the application of heat the colour pigments of dried *Smilax perfoliata* leaf might get discolored. In case appearance, taste, texture, flavor M5 got the highest score i.e. 7.86, 8.2, 7.6 and 8.2 respectively. And M1 got the lowest score i.e. 6.33, 6.5, 6.5 and 5.4 respectively. M5 got highest overall acceptability score i.e. 8.6. During the acceptability trials it was found that among the five developed products M5 was selected who got the highest scores. Therefore, based on the acceptability of sensory attributes M5 was selected for carrying out further analysis.

**4.4 Sensory evaluation of the muffins**

Sensory evaluation has been defined as the sensory attributes of colours, appearance, flavour, taste, texture and overall acceptability by using the 9 point hedonic scale.

It is also defined as a scientific discipline used to evoke, measure, analyze and interpret those responses to products as perceived through the senses of sight, smell, touch and hearing Sedel and Stone (1993).

1. **Colour**

Consumer appetite is stimulated or lost by the colour of a food product. This is because the colour of food indicates the flavour of Food Downham and Collins (2000). The product code M5 had the most preferred colour (8.1) followed by M4 (7.8), M3 (5.9), M2 (5.1) and then the least preferred was M1 (5.1).

![Panellist scores of acceptance test for colour (Hedonic scale of 1-9, where 9 represents 'like very much' and 1 represents 'dislike very much').](image-url)
ii. Appearance

Appearance of the muffin should be rough, pebbled, golden brown surface, slightly rounded and no peak. The product code M5 had the most preferred appearance (7.86) followed by M4 (7.5), M3 (7.4), M2 (6.5) and then the least preferred was M1 (6.33).

Fig: 3 Panellist scores of acceptance test for appearance (Hedonic scale of 1-9, where 9 represents ‘like very much’ and 1 represents ‘dislike very much’).

iii. Taste

Taste, on the perception of gustatory input, is the most influential factor in a person’s selection of a particular food. Taste is perceived by the taste buds, which are primarily on the surface of the tongue, by the mucosa of the palate and in the areas of the throat. The taste preference scores of the M5 muffins which is highly accepted (8.2) followed by M4 (7.7), M3 (7.5), M2 (6.9) and M1 got the lowest score i.e. (6.5).

Fig: 4 Panellist scores of acceptance test for taste (Hedonic scale of 1-9, where 9 represents ‘like very much’ and 1 represents ‘dislike very much’).
iv. Texture

The texture preference scores of the M5 muffins which is highly accepted (7.9) followed by M4 (7.6), M3 (7.5), M2 (6.9) and M1 got the lowest score i.e. (6.5).

![Texture Preference Scores](image1)

v. Flavor

Flavour is the combined senses of taste, aroma, and mouth feel. Mouthful encompasses textural and chemical sensations. The flavour preference scores of the M5 muffins which is highly accepted (8.2) followed by M4 (8), M3 (7.03), M2 (6.4) and M1 got the lowest score i.e. (5.4).

![Flavour Preference Scores](image2)
vi. Overall acceptability

M5 had the highest acceptability score which is (8.06) followed by M4 (7.93), M3 (6.93), M2 (5.63) and M1 got the lowest acceptability score which is (5.36).

![Bar chart showing acceptability scores for muffins M1 to M5.]

Fig: 7 Panellist scores of acceptance test for overall acceptability (Hedonic scale of 1-9, where 9 represents 'like very much' and 1 represents 'dislike very much').

4.5 Moisture content analysis of the formulated muffins

Moisture content of the control muffin and highly acceptable dried Smilax perfoliata leaf powder enriched muffin were determined in present study. It was observed that Smilax perfoliata incorporated muffin (M5) got higher moisture content percentage i.e. 33.2% than control muffin i.e. 32%. Moisture content in bakery products is an important factor as it has a direct impact on the texture and attributes and a strong correlation has been found between moisture content and firmness (Morris & Morris, 2012)

Table 3: Moisture content analysis of control and Smilax perfoliata incorporated muffins

<table>
<thead>
<tr>
<th>Moisture content (%)</th>
<th>Control muffin</th>
<th>Smilax perfoliata incorporated muffins</th>
</tr>
</thead>
<tbody>
<tr>
<td>32%</td>
<td></td>
<td>33.2%</td>
</tr>
</tbody>
</table>

4.6 Shelf life studies and microbial count studies of the developed muffins

The shelf life of the formulated muffins was studied by storing the product in the plastic air tight container for a period of 10-20 days. The organoleptic evaluation was done at regular interval of time. The sensory scores by using 9-point Hedonic scale after storage for 10 to 20 days of selected products. A slight variation was observed in terms of colour, appearance after 15 days of storage. After 15th day of storage period significant changes were observed and fungus growth was observed on 20th day. The organoleptic characteristics changes were drastically declined after 15th 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 is developed due to higher nutrient composition which is favorable for growth of the microorganisms. Muffins prepared with refined wheat flour alone were acceptable up to 10th day of storage but developed Smilax perfoliata incorporated muffins were acceptable up to 15th day of storage period. It was seen that the shelf life of the formulated muffins is over 15days in the plastic air tight containers at room temperature.
4.7 Microbiological quality of the developed muffins

The samples of product were subjected to microbiological analysis are shown in table- 5.

Table 5: Microbiological quality (cfu/ml) of muffins

<table>
<thead>
<tr>
<th>Product code</th>
<th>Total viable count</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15 days</td>
</tr>
<tr>
<td>Control</td>
<td>10</td>
</tr>
<tr>
<td>M5</td>
<td>5</td>
</tr>
</tbody>
</table>

The microbiological count of the selected product revealed that there were 5 microbial colonies found in M5 during 15 days of storage. The microbiological quality of the muffins was good up to 15 days of storage. But after 20 days of storage the product got spoiled and 19 microbial colonies are formed. The range of spoilage of microorganisms is restricted due to inhibitory factors such as low ph, low water activity etc. Several factors encourage, prevent, or limit the growth of microorganisms in muffins; the most important are aw, pH, hygienic practice and storage temperature.

4.8 Nutritive value of the raw ingredients used for making muffin

Table 6: Nutritive value of the raw ingredients used for making muffin

<table>
<thead>
<tr>
<th>Name</th>
<th>Amount (gm)</th>
<th>Energy (kcal)</th>
<th>Carbohydrate (gm)</th>
<th>Protein (gm)</th>
<th>Fat (gm)</th>
<th>Fibre (gm)</th>
<th>Iron (mg)</th>
<th>Potassium (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refined flour</td>
<td>80</td>
<td>278.4</td>
<td>59.12</td>
<td>8.8</td>
<td>0.72</td>
<td>0.24</td>
<td>2.16</td>
<td>122</td>
</tr>
<tr>
<td><em>Smilax perfoliata</em> flour</td>
<td>20</td>
<td>95.47</td>
<td>18.37</td>
<td>4.97</td>
<td>0.235</td>
<td>0.19</td>
<td>0.492</td>
<td>9.35</td>
</tr>
<tr>
<td>Sugar</td>
<td>51</td>
<td>199</td>
<td>49.7</td>
<td>0.05</td>
<td>-</td>
<td>-</td>
<td>0.0775</td>
<td>1</td>
</tr>
<tr>
<td>Egg</td>
<td>120</td>
<td>207.6</td>
<td>-</td>
<td>15.96</td>
<td>15.96</td>
<td>-</td>
<td>2.36</td>
<td>141.75</td>
</tr>
<tr>
<td>Baking powder</td>
<td>4.3</td>
<td>2.65</td>
<td>1.4</td>
<td>-</td>
<td>-</td>
<td>0.01</td>
<td>0.55</td>
<td>1</td>
</tr>
<tr>
<td>Oil</td>
<td>21</td>
<td>180</td>
<td>-</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Milk</td>
<td>75</td>
<td>50.25</td>
<td>3.3</td>
<td>2.4</td>
<td>3.075</td>
<td>-</td>
<td>0.15</td>
<td>105</td>
</tr>
<tr>
<td>Total</td>
<td>1013.37</td>
<td>131.89</td>
<td>32.18</td>
<td>39.99</td>
<td>0.44</td>
<td>5.789</td>
<td>380.1</td>
<td></td>
</tr>
</tbody>
</table>
Nutritive value of the selected formulations was calculated and all the formulations had high nutritive value. Smilax perfoliata leaf powder has high energy and carbohydrate value as shown in the table 6. The formulated muffin has high energy value i.e. 1013.37 kcal and high carbohydrate value i.e. 131.89 gram and high fat i.e. 39.99 gram.

**SUMMARY AND CONCLUSION**

The present investigation was carried out to develop muffins by using dried *Smilax perfoliata* leaf powder and to perform their sensory evaluation on a 9-point hedonic scale by a semi trained panel of judges. Analysis of the moisture content of the formulated muffin was also carried out. The shelf life of the selected product was also evaluated.

In this chapter salient findings of the present study are summarized in brief and finally concluded.

**Summary:**

5.1 Formulations of muffins by using dried *Smilax perfoliata* leaf powder

5.2 Acceptability trials of the formulated muffins

5.3 Moisture content analysis of the formulated muffins

5.4 Shelf life and microbiological studies of the formulated muffins

5.1 Formulations of muffins by using dried *Smilax perfoliata* leaf powder

A present study aimed to develop muffins. Muffins were developed to enhance the quality, taste and flavor. There was five different formulations were done in the laboratory of Department of Food, Nutrition and Dietetics.

5.2 Acceptability trials of the formulated muffins

Acceptability trials were conducted by semi trained panel consisting of 30 numbers from the Department of Food, Nutrition and Dietetics. Scoring was done on nine point hedonic scale. The various formulations were followed to develop muffins. The developed muffins were sensorily evaluated. The results of the sensorily evaluation test revealed that M5 product was likely by the semi trained panel of judges.

Among the five formulations M5 got the highest score in overall acceptability i.e. 8.06. Similarly M1, M2, M3 and M4 got 5.36, 5.63, 6.93 and 7.93 respectively in terms of overall acceptability.

Nutritive value of the selected formulations was calculated and all the formulations had high nutritive value. Smilax perfoliata leaf powder has high energy and carbohydrate value. And formulated muffin is rich in carbohydrate, protein and fat content.

5.3 Moisture content analysis of the formulated muffins

Moisture content of the control muffin and highly acceptable dried *Smilax perfoliata* leaf powder enriched muffin were determined in present study. It was observed that *Smilax perfoliata* incorporated muffin (M5) got higher moisture content percentage i.e. 33.2% than control muffin i.e. 32%. Moisture content in bakery products is an important factor as it has a direct impact on the texture and attributes and a strong correlation has been found between moisture content and firmness.
5.4 Shelf life and microbiological studies of the formulated muffins

The sensory evaluation for the formulated muffins did not change up to 15 days of storage. Though five formulations were shown slightly change in colour, appearance, taste and flavor at 20 days, but the muffins remain acceptable up to 15 days of storage. The microbiological count was done to find out the acceptable quality of the formulated muffins for storage up to 15 days. The microbiological count of the selected product revealed that there were 5 microbial colonies found in M5 during 20 days of storage. The microbiological quality of the muffins was good up to 15 days of storage. But after 20 days of storage the product got spoiled and 19 microbial colonies are formed.

CONCLUSION

It is concluded that the present study of the development of muffins by using dried Smilax perfoliata leaf powder formulated showed to have high nutritive value, antimicrobial activity and has a potential of having many health benefits. From the data presented in the current study, it is found that the muffins can be prepared at domestic level and can be stored for 15 days. The microbiological count of the selected product revealed that there were 5 microbial colonies found in M5 during 15 days of storage. The microbiological quality of the muffins was good up to 15 days of storage. Smilax perfoliata incorporated muffin (M5) has higher moisture content percentage i.e. 33.2% than control muffin i.e. 32%. The formulated muffin has high energy value i.e. 1013.37 kcal and high carbohydrate value i.e. 131.89 gram and high fat value i.e. 39.99 gram. Hence the results of the present research can be used as valuable information for development of muffin by using dried Smilax perfoliata leaf powder.

REFERENCES


