

ATTEMPTING THE DEVELOPMENT OF A FORTIFIED BREAD- BY INCORPORATION OF CURRY LEAVES AND ANALYSING ITS IMPACT ON THE NUTRITIONAL AND SENSORY QUALITY

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INTRODUCTION

Bread is most critical, reasonable and simple eating nourishment which appeared a great many years back (Shahnawaz,*et al.*,2012). Bread is known to be the introduction of bakery product which is also a successful experiment by Egyptians over 12000 BC. It is known to be the most convenient and accepted food in the world (Udeme Joshua Josiah Ijah, *et al.*, 2014). There are so many varieties of bread present in market that are claiming to be healthy one after the other and many companies claims that the recipe is simple (wheat flour, water, salt, sugar, oil and yeast) and the use of wheat flour in some amount will not harm the human (Lilleberg,2012). There are many flours that are incorporated now days so wholesome substance of the sustenance can be upgraded and furthermore the infections that are influencing individuals can be limited with the utilization of good alternatives than utilizing the same. In this way the present investigation is focussed on the utilization of curry leaves powder in bread to expand its healthful incentive as it is a rich source of different vitamins, minerals, cancer prevention agent and assortment of other fundamental supplements.

During the previous couple of years various analyses were directed to enhance the dietary estimation of bread like fiber rich, sugar free, cancer prevention agent rich bread and fat free breads. Curry leaf is a decent source of mineral supplements. It contains noteworthy measure of iron, copper and zinc. Curry leaves are rich source of Vit A, Vit B, Vit C, Vit B2 and Ca. It can act as a natural calcium supplement for people with calcium deficiency, osteoporosis etc. Curry leaves stimulate metabolism, restores alkalinity to the blood. Curry leaves also act as a detoxificant and help restore healthy cells. They have different cancer prevention agent properties and the ability to control looseness of the bowels, gastrointestinal issues like acid reflux, unnecessary corrosive discharge, peptic ulcers, diabetes and an undesirable cholesterol alter. They are similarly acknowledged to have tumor fighting properties and are known to secure the liver. Curry leaves of common curry plant, is freshly juiced or dried into powder for human consumption. Curry leaves powder acts as a complete nutritional and possible health implications as it can overcome many therapeutic needs like natural liver cleanser, balances hormones, controls cholesterol and diarrhea, etc. Although, curry leaves powder has various beneficial effects but it is not consumed by people and is also not available in food products

much. Therefore along these lines an attempt has been made to advance its value with the goal that its utilization can be expanded.

The main focus is on public health, an issue which is the main concern as our daily food doesn't meet the nutritional requirements or the sources are very much limited. Fortification of curry leaves powder in bread is an easy way to include that requirement in our daily breakfast. Food fortification has been defined as the addition of one or more nutrients to a food to improve its quality for the people who consume it, usually with the goal of reducing or controlling nutrient deficiency (Mahamud, *et al*, 2012). Curry leaves powder would easily be consumed by this method and also can naturally be used for regular consumption in the form of powder or juices blended with other ingredients. Moreover, curry leaves are known for its therapeutic value since ancient times the nutrients present in curry leaves helps to promote health and healing. Regular consumption of curry leaves powder eliminates toxin from body, reduce cholesterol, improves digestion, improves hair growth and helps in prevention of illness.

As consumption of curry leaves either in powder or juice form is not so popular, therefore, the present study was conducted to study the nutrient composition, physicochemical properties and sensory studies of both curry leaves powder and the bread formulated with the incorporation of curry leaves powder with following objectives:

- Development of bread using different concentration of curry leaves powder.
- To evaluate the antioxidant activity of the bread extract.
- To study the preliminary phytochemical screening of the bread extract.
- To study the sensory evaluation of the final product.

Bread

Bread, biscuit, cake, noodles and other wheat flour based products are common in India and in many other countries and is been consumed from thousand years ago. Among all, bread is the most popular wheat-based products (Nwanekezi, 2013). The first bread was made as a result of deliberate experimentation with water and grain flour. In recent years different varieties of breads are available in market with improved nutritional value along with different flavours. With urbanisation and globalisation, the ready to eat food becomes inevitable in today's world and as, bread is easy to make and carry anywhere, it has become one of the most loved breakfast food among all age group (Mir, *et al.*, 2014). The major components in bread are basically wheat flour, yeast and water. Changes in ingredients also affect the acceptability which is the main challenge for a new product that comes into market (Appolonia and Morad, 1981). There are many researches going on in improving and increasing the nutritional content of bread in various places due demand of human body and also such nutrient fortification helps in treating diseases naturally (Annusoya S.Sivam, *et al.*, 2010).

As compared to other cereal flours, wheat flour has some uniqueness in preparation of bakery products. This is because of its gas retaining capacity during proofing and baking. As a result, it

forms a typical aerated foam structure that we know as bread. This uniqueness in wheat flour is largely due to its gluten protein which is made up of gliadins and glutenins that make distinctive commitments to the viscoelasticity of gluten. The gliadins are viscous and extensible but lack elasticity while glutenins lack extensibility but show substantial strength and elasticity. Gliadin cannot retain gas, due to its extensibility, glutenin can retain gas but the gas cannot expand or grow due to its strength (elasticity). In this manner, the mix of the two kinds of proteins (gliadins and glutenins) confers the one of a kind viscoelastic properties in charge of gas retention in wheat flour (Nwanekezi, 2013).

Bread Making Process

a) Ingredients collection and measuring

Using of good ingredients and its quality matters a lot while making the bread. We have used the following ingredients:

- Refined flour: Refined flour is the basic ingredient and is used for giving sponginess, texture, volume to the dough and colour.
- Oil/Shortening: Oil is used to give soft texture and helps to extent gluten to extend and adds nutritional value of the bread. Shortening (ghee or margarine) increases the machinability or specifically slicability (Mondal, and Datta, 2007).
- Yeast: Fermentation is caused by baker's yeast which is the trade name of the organism *Saccharomyces cerevisiae*. Due to fermentation, sugar is converted to moisture and CO₂ (Mondal, and Datta, 2007). Zymase, the main enzyme present in yeast helps in fermentation of the dough so that when bread is consumed it is easily digestible and nutritious.
- Salt: Salt is added to strengthen the gluten and to convert the action of yeast for controlled expansion of the dough (Mondal, and Datta, 2007). Salt also increases the taste and tightens the protein and fat, mixes with sugar, keeps the bread soft and moist.
- Sugar: The process of fermentation is started by the addition of sugar.. The main role of sugar is to multiplication of yeast cells. Sugar slows down starch component for time being. It also helps in improving colour, texture and softens the bread (Mondal, and Datta, 2007).
- Water: water is essential in dough formation. Its main function is formation of protein called as gluten which is important for bakery products.

b) Mixing the ingredients

Mix the ingredient in a bowl and start to give the shape of soft dough so that the ingredients can be mixed properly and gluten formation takes place.

c) Proofing

The dough is left for its first rising that is the work of yeast gets started when the dough is kept aside for some time. The sugar thus helps in fermentation.

d) Divide and proofing

The dough finishes its first proofing process, then the dough is separated into two parts and beaten on the flat surface and mix the two parts into one another and leave it for final proofing.

e) Shaping

The dough is then given a shape of a loaf so that it is ready to bake as the final step.

f) Baking

Before baking the oven is preheated at 180 for 30 minutes and the loaf is kept for baking till the colour of the bread turns to brown from the top.

g) Cooling

Cooling step is important to get the original taste of the bread and excess steam and moisture can be removed. The excess steam can result in different flavours while the baking steps have taken place.

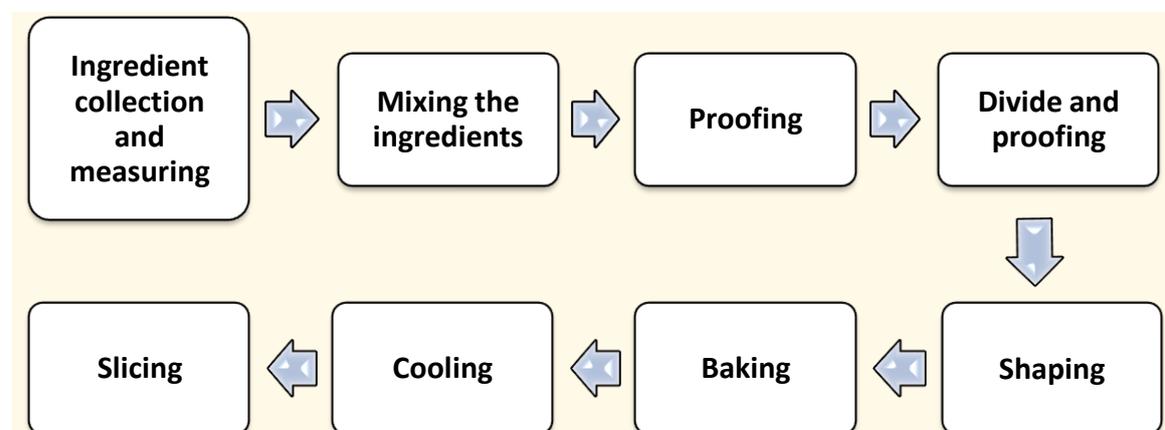


Fig. 3 Bread Making Process Flow chart

Curry Leaves

| | |
|-------------|---|
| Common Name | <i>Murraya Koenigii</i> |
| Family | Rutaceae |
| Place | found through out India, common in states like Meghalaya, particularly in Khasi hills undergrowth in deciduous forests |
| Other Names | as “Karivepaku” in Telugu, “Mithanim” in Hindi, “Kariapala, Kariveppu” in Malayalam, “Karibevu” in Kannada, “Curry leaf” in English |

Curry leaf has a slightly pungent, bitter, and slightly acidic intaste. It is known to have number of medicinal properties It contains several bioactive compounds with health-promoting properties. Different parts of *M. koenigii* have been used for the treatment of cough, hypertension, hysteria, hepatitis, rheumatism, poisonous bites, and skin eruptions. In addition, curry leaf has been reported to have antitumor, antioxidant, anti-inflammatory, anti-hyperglycemic and hypoglycemic effects.

Curry leaves are powerful health food supplement. It is a great source of vitamins and minerals. It is consumed in the form of dried powder to incorporate in other foods.

The curry leaves is green in colour and has soft texture due which it gives an impression of green vegetables. In today’s time the curry leaves powder is available in various forms and consumed by incorporating it in various products like in bakery products for example in cookies, biscuits, muffins, cakes, breads etc. It can be consumed by anybody in spite of being considered as poor people diet. The other reasons for the less intake of curry leaves are its taste, aroma and also the shelf life of the product. In many shops the curry leaves juices and powders are available with very high prices and hence various researches have been conducted to make people aware of its nutritional benefits along with various possibilities of its fortification with other foods for better use (Singal, et al, 2012). The three most important functions of curry leaves are:

- Lowers cholesterol
- Protects liver
- Improves digestion

Nutritive Value**Table 1: Comparative nutrient content of fresh and dehydrated curry leaves**

| Nutrients | Value of fresh curry leaves (100g) | Value of dehydrated curry leaves (100g) |
|--------------|------------------------------------|---|
| Protein | 6 g | 12 g |
| Carbohydrate | 18.7 g | 64.31 g |
| Fat | 1 g | 5.4 g |
| Iron | 0.93 mg | 12 mg |
| Calcium | 830 mg | 2040 mg |
| B-carotene | 7560 µg | 5292 µg |

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Table 2: Vitamin content of Curry leaf

| Vitamins | Values (mg/100g) |
|---------------------------|------------------|
| Vitamin A (B-carotene) | 6.04 ± 0.02 |
| Vitamin C (ascorbic acid) | 0.04 ± 0.002 |
| Vitamin E (α-tocopherol) | 0.03 ± 0.001 |
| Vitamin B1 (thiamin) | 0.89 ± 0.01 |
| Vitamin B2 (riboflavin) | 0.09 ± 0.002 |
| Vitamin B3 (niacin) | 2.73 ± 0.02 |

Table 3: Mineral elements of Curry leaf

| Minerals | Values (mg/100g) |
|-----------|------------------|
| Calcium | 19.73 ± 0.02 |
| Zinc | 0.04 ± 0.001 |
| Iron | 0.16 ± 0.01 |
| Sodium | 16.50 ± 0.21 |
| Magnesium | 49.06 ± 0.02 |
| Potassium | 0.04 ± 0.001 |

Formulation of Bread

The basic formulations used for preparation of breads are outlined in the Table below. The breads were prepared with the incorporation of different concentrations of curry leaves powder along with other ingredients concentration. Prepared bread was tested and analysed against the control bread (with addition of curry leaves powder). Based on the sensory analysis, the best combination was determined and final analysis have been carried out. The recipe was repeated in many trials, altering the quantities of ingredients in definite proportions, which produced similar results of the product. Thus, the recipe of the product was standardized.

Table: 2 Different combination of bread baked

| Ingredients | CLB 3% (per 100 g) | CLB 5% (per 200g) |
|-------------|-----------------------|----------------------|
| RW flour | 97 | 190 |
| CL powder | 3 | 10 |
| Yeast | 3 | 6 |
| Salt | 1 | 2 |
| Sugar | 5 | 10 |

Bread Making Process

- The pre-weight ingredients were mixed properly.
- The yeast and sugar were dissolved in water at temperature 45 °C.
- Mixture of raw materials was added to obtain uniform dough and the dough was allowed for proofing for 1 hour.
- The dough is transferred to lightly floured surface and pressed gently using fingertips.
- The dough is then shaped into rectangle and folded from all four sides and placed into the mould.
- After the dough was again kept in greased baking mould for proofing for the second time for 30 minutes.
- The dough is then kept for baking at 200-220°C for 20-30 minutes, cooled to room temperature and cut into slices and wrapped in foil.

EVALUATION OF ANTIOXIDANT ACTIVITY

DPPH free radical scavenging activity

The antioxidant activity of ethanolic extracts was measured in terms of hydrogen donating or radical scavenging ability by using the stable radical DPPH (1,1-diphenyl-2-picrylhydrazyl).

- 1) The blank consisted of about 3.8 mL of ethanol, while control comprises of 3 mL of ethanol, 0.3 mL of 0.4 mM DPPH solution.
- 2) Reaction mixture was prepared by blending 3 mL of ethanol, 0.5 mL of ethanolic extracts of curry leaf bread and 0.3 mL of 0.4 mM DPPH solution.
- 3) The blank, control and reaction mixture solutions were allowed to incubate in the dark for 30 min.
- 4) The color of the reaction mixture fades as compared to the control and the reduction was observed by the decrease in the absorbance at 517 nm.
- 5) The results were compared with the positive control i.e., standard quercetin.
- 6) Finally the percentage inhibition of the DPPH radical was measured by using the following formula:

$$\text{Percentage of inhibition} = \frac{\text{Absorbance of control} - \text{Absorbance of reaction mixture}}{\text{Absorbance of control}} \times 100$$

Result:

It was found that ethanolic extract of curry leaf bread has shown **negative** free radical scavenging activity using DPPH method.

PRELIMINARY PHYTOCHEMICAL SCREENING

1. TEST OF FLAVONOID

2 ml of 10% NaOH is added to 1 ml plant extract. The intense yellow color is obtained. On adding HCl (1%) it changes to colorless. This indicates the presence of flavonoids.

2. TEST OF PHENOLS

To 1 ml extract add 5 ml of distilled water or alcohol mix (70%) and add 1-2 drops of 1% FeCl₃. A red-blue-green or purple color indicates phenols.

| S. No. | Sample | Flavonoid | Phenols |
|--------|---------------|-----------|---------|
| 1. | Bread extract | +ve | +ve |

RESULT AND DISCUSSIONS

Two breads have been prepared using 3% and 5% of curry leaves powder in combination with refined wheat flour. Both the prepared breads were subjected to sensory evaluation in order to

optimise different sensory attributes (colour, texture, taste, flavour and overall acceptability) and based on sensory evaluation the best combination was selected, the final bread was prepared and was subjected to further analyses.

Optimization of Bread by Sensory Evaluation

The sensory evaluation of the 2 different samples was carried out by 7 semi trained panel members. On the basis of sensory score the formulation was optimized. Comparative analysis of all the samples is shown in the table below.

The analysis indicated that there were considerable differences in flavour, textures and the overall acceptability between control bread and bread containing different concentration of curry leaves powder. With the increase in the level of curry leaves powder in the formulation, the sensory scores for colour, texture, appearance and flavour of bread differed considerably. Up to 3% incorporation of curry leaves powder the grassy flavour has been observed to be masked successfully, but beyond that on further increasing curry leaves powder there was impact on volume expansion, formation of proper crump and crust structure. With all added ingredients, the 3% curry leaves powder incorporated bread scored maximum overall acceptability value.

Table: 6 Showing Sensory Evaluation

| Parameter | S1 (3%) | S2 (5%) |
|-----------------------|---------|---------|
| Appearance | 8 | 7 |
| Colour | 8 | 7 |
| Texture | 7 | 6 |
| Odour | 8 | 6 |
| Taste | 7 | 6 |
| Overall Acceptability | 8 | 6 |

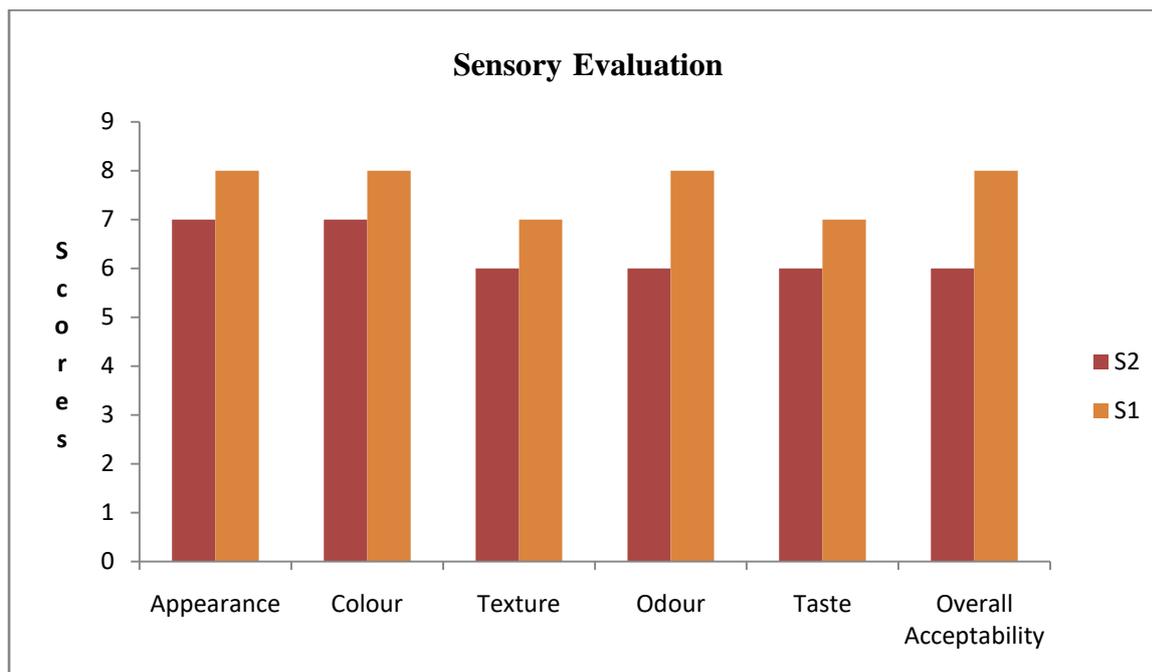


Fig. 9 Sensory Evaluation of different conc. of bread

Where, S1 and S2= Concentrations of breads at 3% and 5%

Based on this, 3% curry leaves incorporated bread was considered to be the best and was again prepared to carry out further analyses.

Sensory Evaluation

The product prepared i.e. bread with incorporation of curry leaves powder has been evaluated by 10 panellists and scores are given on basis of the following points:

Appearance: the appearance of the bread was appealing, baking technique is unique make it acceptable by the consumers.

Colour: Colour is very important aspect in food as it increases the visual appearance, increases the anxiety to eat a new product.

Texture: Texture of the bread was soft as the bread should be, the green colour also gives an appeal of having green food in diet is incorporated as it increases the nutritional content of the bread.

Odour: The smell of the bread gives feel of grass but by adding milk powder and orange peel powder gives a pleasant odour.

Taste: Taste of the bread increases by increase of curry leaves and it is acceptable by consumer or not is according to them.

Overall acceptability:The overall acceptability matters a lot for the new product and all the above points are been considered

Table: 11 Comparative Sensory Analysis of Control and CLB

| Parameter | C (0%) | CLB (3%) |
|-----------------------|--------|----------|
| Appearance | 8 | 8 |
| Colour | 8 | 8 |
| Texture | 8 | 7 |
| Odour | 7 | 8 |
| Taste | 8 | 7 |
| Overall Acceptability | 8 | 8 |

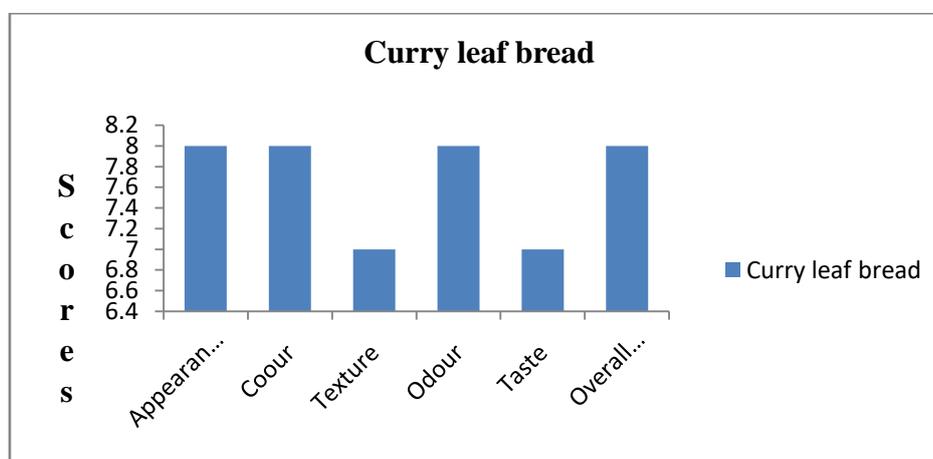


Fig. 15 Sensory Evaluation of Bread (3%)

SUMMARY AND CONCLUSION

Bread is a staple food of people in India but also in other parts of world. It is prepared with refined flour, oil/butter, yeast, sugar, salt and water. During the past few years a number of experiments were conducted to improve the nutritional value of bread like fiber rich, sugar free, antioxidant rich bread and fat free breads. Although the nutritive value increases, often the problem arises with the acceptability of the product.

Bakery products are easy but the cooking time and ingredients change the composition and method of preparing it. The main idea for the study was to increase the nutritional aspect of the bakery product bread. The study started by experimenting and exploring of different ingredients that can enhance the flavour and taste of the bread. Curry leaves powder is a full food which fulfils the daily nutritional requirements.

There are many studies done with curry leaves powder in bakery products like biscuits, cookies, muffins. The property with each bakery product is different so as the use of curry leaves. The main focus upon is incorporation of the powder to give a new product.

Sensory evaluation was done with each concentration of the bread to know the better product among them and the points included for evaluation are Appearance, odour, taste, flavour, texture and overall acceptability by 10 panellists.

From the analysis it is concluded that the incorporation of curry leaves powder less than 4 percent will be acceptable by the consumers and will have nutritional properties. Also change of ingredients like oil to butter has given a good taste and resulted in increase the quality of bread. The Shelf life of the bread was calculated and sensory evaluation was also done, by the end of third day the growth of microbes was observed.