



# Formulation and Organoleptic Evaluation of Lotus Stem Fortified Cookies

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## ABSTRACT

Lotus stem has extraordinary medicinal value. It has high iron, calcium, dietary fibre and effective constituents like starch, protein, asparagines, pyrocatechol, gallic-catechin, neochlorogenic acid, leucocyanidin, peroxidase, vitamins B and C. It is used for curing fever, diarrhoea, haemorrhages, dysentery, high BP, excessive menstruation. Even after such good functional qualities it is found to be under consumed vegetable. Incorporation of this in traditional ingredients is best way to introduce them in daily diet of people. On the line of this, the present attempt was made to form its powder by hot air drying process and blend it with different traditional ingredients for product formulation. Preparation of lotus stem powder was done by the following process: Washing and cleaning of sample, slicing, blanching chips, hot-air oven drying at 60°C for 2 hours, were grinding for preparation of powder. Yield was carefully recorded. 175 g Powder was prepared from 500 g lotus stem. Powder was acceptable and it was brownish off white in colour. Review study that it contains: Energy 234 kcal. Protein 4.1 g, carbohydrates 51.4 g, fat 1.3 g, fibre 25.0 g, Iron 60.6 g, calcium 405 mg, phosphorus 128 mg, sodium 438 mg, potassium 3007 mg.

Due to various side effects associated with long term use of medicines, administration of functional foods and nutraceuticals products are chief mode of therapy. Therefore, there is a need to promote under consumed but nutritionally and functionally rich foods.

**Keywords:** Lotus stem; Hot air drying; Nutraceuticals; Plant constituents; Formulation

## INTRODUCTION

Lotus stem are Kamal kakdi, is (most of the times wrongly called as lotus root) very popular vegetable in India and several other Asian countries including China and Japan. *Nelumbo nucifera* is the scientific name of the lotus stem [1].

Lotus stems are long, plump and light brown in color and the height of the stem may vary anywhere between 2 meters to 4 meters. When the outer skin of the stem is peeled and then chopped in to pieces, you can find small holes inside it, which are nothing but air cubicles running through the entire lotus stem. This lotus stem is loaded with full of nutrition and has some tremendous health benefits [2].

## Nutritional value of lotus stem

The nutritional value of lotus stem is pretty impressive. It is rich in calcium, iron, fiber and many important minerals like zinc, manganese, magnesium, potassium, copper, etc. It is also loaded with vitamin B, vitamin E, vitamin K etc.

100 grams of lotus stem contains around 234 kcal of energy, 9.5 gram of moisture, 51.4 grams of carbohydrates, 4.1 grams of protein, 25 grams of fiber, 1.3 grams of fat, 0.39 mg of zinc, 3007 mg of potassium, 128 mg of phosphorus, 405 mg of calcium, 168 mg of magnesium, 60.6 mg of iron, 0.25 mg copper, 438 mg of sodium, 3 mg of vitamin C, 1.9 mg of niacin, 0.82 mg of thiamine and 1.21 mg of riboflavin [3-6].

**Lotus stem selection procedure:** While selecting the lotus stem, you need to be very much sure in buying the ones that are firm, tender and those that does not have soft spots on them [7].

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Make sure to check that the skin of the lotus stem is smooth and unblemished. You can also get tinned lotus stem and frozen lotus stem too. However, it is advised not to buy the tinned lotus stem.

**How to choose good lotus stem?:** For the best culinary experience, go for younger lotus stem. The younger the stem, the tendered it is. Young lotus stem are smaller in size and have a pale brown, almost whitish skin. Old lotus stem are not only significantly bigger, but also tend to turn dark brown. Also, avoid lotus stem with spots and blemishes, soft parts and any other similar defects. A firm, medium-sized root should meet all of your culinary demands [8].

## LITERATURE REVIEW

The review of literature for the study “formulation and organoleptic evaluation of lotus stem fortified cookies” is presented in this chapter under following heads:

- Lotus stem.
- Nutritional value.
- Medicinal use of the lotus roots.
- Active compounds.
- Other studies on lotus stem and product.

**Lotus stem:** Importantly, lotus products are not only used as food but also as herbal medicines, including the stamen, pistil, leaf, seedpod, root node, and other parts of the lotus, as recorded in the “Chinese pharmacopoeia”.

**Nutritional value:** The lotus consists of 1.7% protein, 0.1% fat, 9.7% carbohydrate, and 1.1% ash. The stems contain 6 mg, 2.4 mg, and 0.2 mg/100 g of calcium, iron, and zinc, respectively.

The mature seeds of *N. nucifera* consist of around 8%-10% moisture, 25% protein, 3.7% crude fat, 65% carbohydrate, 3%-4% crude fibre, 4% ash, and contain 388 cal/100 g of energy. Mineral composition of 100 g of lotus seeds consists of sodium (7.86 mg), potassium (48.5 mg), calcium (313 mg), phosphorus (6.25 mg), magnesium (43.9 mg), copper (2.51 mg), zinc (7.72 mg), manganese (16.6 mg), iron (16.4 mg), and selenium (1.04 mg) [9].

**Medicinal use of the lotus roots:** Aqueous extracts from the lotus roots presented different phenolic, tannin, and flavonoid content than the lotus leaves, but have also shown antioxidant activity.

**Active compounds:** All parts of the lotus plant have yielded significant amounts of phenolic and flavonoid compounds Bhat, et al. For the flavonoid contents, determined as mg of (+)-equivalent per g of dried extract (CE, mg/g extract), the order was: Leaves (125.6)> de-embryonated seeds (82.9)> stamens (50.3)> embryos (18.9)> roots (8.5).

### Other studies on lotus stem and product

- According to Chiang PY, Luo YY, the effects of pressurized cooking on the relationship between the chemical compositions and texture changes of lotus stem (Gaertn.)
- Y. Chhavi, et al., reported that the different part contains different chemical constituents which enhance its medicinal

value in different diseases. This article review the ayurvedic literature, traditional uses, phytochemistry and therapeutic reports on different parts of .

## METHODOLOGY

This chapter of study is mainly concerned with methodology aspects pertaining to the resent investigation. The design of the study to the logical manner in which units of study were assessed and analyzed for the purpose of drawing conclusion.

The present investigation entitled “formulation and organoleptic evaluation of lotus stem fortified cookies” will be carried out in the Kanpur.

**Period of study:** 2023-2024.

**Plan of the study:** Preparation of sample, sensory evaluation and nutritional analysis of lotus stem fortified cookies.

This chapter contains relevant information pertaining to the research design and methodological steps used for the present investigation. The research procedures have been distinctly described under the following heading and sub-headings.

- Procurement of raw material.
- Ingredients are used in preparation of lotus stem fortified cookies.
- Details of ingredient used.
- Equipment and utensils used.
- Preparation of sample.
- Nutritional analysis of lotus stem fortified cookies.
- Standardization for development of product.
- Microbiological analysis of lotus stem fortified cookies.
- Sensory evaluation of lotus stem fortified cookies.
- Statistical analysis.

### Research design

- Determine amounts of various ingredients for formulation of fortified cookies standardization of a recipe for the development of fortified cookies.
- Selection, procurement and processing of the ingredients (lotus stem powder, refined flour, butter and sugar).
- Determine the shelf life of the prepared product.
- Analyse and calculate the nutritive value of prepared product.
- Organoleptic evaluation of prepared product.
- Data analysis and report writing.

### Significance of research

Lotus stem powder can be incorporated in cookies as a partial replacement of refined flour which can be incorporated in cookies without negatively affecting the physical and sensory quality. This present study shows that there exists potential for lotus stem powder and refined flour incorporation of baked products.

New formulations could therefore be tested aiming at the development and consumption of food fortified with higher proportions of functional and nutritious ingredients. The new functional foods can be designed by using LSP in future.

Millets are rich in dietary fiber and help in digestion and prevent constipation. Kodo millet contains high dietary fiber that is 3 times more than wheat and maize and 10 times more than rice. The high fiber content in millets acts as pre-biotics and thus helps to maintain a healthy gut microbiome. Millets are absolutely gluten free and it is good for celiac patients. Millets are rich in antioxidants which protect our cells from free radicals. But these millets are also underutilized due to its coarse structure. Therefore, there is a need of research studies as formulation of its value added products for its utilization

## Objective

The following objective of the study was made of investigation:

- Procurement of raw material.
- Ingredients are used in preparation of lotus stem fortified cookies.
- Standardization for development of product.
- Preparation of sample.
- Sensory evaluation of lotus stem fortified cookies.
- Nutritional analysis of lotus stem fortified cookies.

## Chapter plan

- The present investigation entitled “formulation and organoleptic evaluation of lotus stem fortified cookies” will be carried out.

**Table 1:** Variation of lotus stems powder and refined flour.

No. of treatment	I	II	III
No. of samples (ratio) LSP:RF	75:25 (100 gm)	50:50 (100 gm)	25:75 (100 gm)
Lotus stem powder	75	50	75
Refined flour	25	50	25

## Sensory evaluation of product

The overall acceptability for cookies range from 9-5 among which the most acceptable product was sample a having 25% LSP and followed by the product sample B and sample C having 50% and 75% of LSP of the mixture respectively. The least acceptable product was sample C having 75% LSP of mixture.

**Table 2:** Recipe for fortified cookies.

Product code	Amount of LSP
Standard	Nil
Sample A	25%
Sample B	50%
Sample C	75%

**Formulation:** To procure these millets for product formation.

Formulation and standardization of different food products in laboratory from the selected millets incorporated with suitable ingredients. To sensory or organoleptic evaluations of formulated products.

## Plan of the study

- Preparation of sample, sensory evaluation and nutritional analysis of lotus stem fortified cookies.
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## Hypothesis

The hypotheses generated for the present study are as follows.

CHbXfXrUjcb Zcf Xj Ycda YbhcZdfcXl WfHUVY%L

The least acceptable of the product may be contributed to the unacceptable after taste also while preparation of the batter, with increase amount of mixture the binding capacity of batter decrease leading to poor binding thus by making the appearance and color unacceptable (Table 2).

**Sensory evaluation:** Sensory analysis is a logical practice which administers the laboratory design and statistical examination and determination to the use of human senses for the purpose of estimating consumer products. The practice depends upon panels as sensors, on whom the products were tested and the

responses were recorded. With the application of statistical techniques to the results, it was possible to make inferences and insights about the products under test. Most large consumer goods companies have departments dedicated to sensory evaluation. For assessing the acceptability of the product formulated through evaluation, score cards were prepared on the basis of different attributes like appearance, flavor, texture, odor, and overall acceptability.

## CONCLUSION

Though lotus stem offers a lot of health benefits, it is always essential to note that you must not take it to treat any medical condition without consulting with your physician, so as to keep away from the side effects of the stem.

Cookies are bakery products rich in fat and sugars. Fortified cookies were developed using Lotus Stem Powder (LSP) incorporated with refined flour. Protein, moisture, ash and fats were determined, and physiochemical assessment of cookies (snack product) prepared from incorporation of Lotus Stem Powder (LSP) were performed.

Lotus stem has extraordinary medicinal value. It has high iron, calcium, dietary fibre and effective constituents peroxidise vitamins B and C. This study aimed at developing formulations of cookies with partial replacement (standard-0%, R1-25%, R2-50% and R3-75%) of refined flour with lotus stem powder for preparation of cookies as well as evaluating physical, physicochemical and sensory characteristics of the cookies.

Through the present study, it was observed that the partial replacement of refined flour with lotus stem powder in the production of cookies was effective in reducing the percentage of (LSP) in the final product, with maximum reduction of 25% in formulation R1, without changing the other parameters. Once the (LSP) was increased, the size of the cookies after baking decreased, therefore increasing the crispness of the cookies made from the formulation with the highest level of replacement, represented by R1, which were evaluated by the

five expert panels members which impacted the sensory evaluation of favour for the product, while formulation R2, with 50% replacement by (LSP), presented similar results to the standard product, being the formulation with the greatest sensory acceptance and physical characteristics. Therefore formulation R1 was been good in nutritional and sensorial performance, and then it is best formulation

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