



DEVELOPMENT OF AN INNOVATIVE LADDU FOR LACTATING WOMEN AND ITS SHELF- LIFE STUDY

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ABSTRACT

Statistics shows that, in India, the rate of exclusive breastfeeding in the first six months stood at 55%. Early initiation of breastfeeding and exclusive breastfeeding can prevent nearly 99,499 deaths of children every year due to diarrhoea and pneumonia. Exclusive breastfeeding is the best way to accomplish optimal growth and health in infants. An innovative nutritious laddu was standardised which had a unique blend of galactagogues which helps in inducing or enhancing breast milk production. This product was rich in protein, fibre, iron, calcium and was gluten-free. It was prepared using galactagogue such as gum arabic (dink), fenugreek, ajwain, suwa powder and seeds like lotus seed (makhana), chia, pumpkin, sesame and flax seeds. Studies indicate that fenugreek, carom seeds or ajwain have properties of galactagogues, which helps in breast milk production in mothers postpartum. A shelf life study was done using a scoring test on a 7-point sensory scale for a period of one month and was found to be highly acceptable. The evaluation was performed on sensory attributes such as colour, taste, texture, aftertaste and overall acceptability. The product was wrapped in chocolate foil, packed in Zip lock stand up pouch made with kraft material with inner polythene lamination. Other aspects covered in the study were labelling, budgeting and marketing.

Keywords: galactagogue, lactating laddu, lacto munchies, gluten-free, protein and fibre enriched, iron and calcium enriched, fenugreek powder, ajwain, sensory evaluation

INTRODUCTION

Laddu or laddoo are sphere-shaped sweets from the Indian subcontinent. They are made with flour, ghee/oil/butter and sugar, with other ingredients that vary by recipes.

Many physicians have recommended that mothers breastfeed their babies -- as breastfeeding comes with many health benefits for both a mother and her infant -- but many babies may never receive breast milk, especially in certain countries. Exclusive breastfeeding for infants until the age of 6 months, with continued breastfeeding to a minimum of 2 years, is strongly endorsed by the World Health Organization, and numerous efforts have been followed for this recommendation globally. A new UNICEF report ranking countries by breastfeeding rates shows that in high-income countries, more than one in five babies is never breastfed, whereas in low- and middle-income countries, one in 25 babies is never breastfed. Nepal being a low income (according to world bank income grouping) has 99.1% children and India has 95.5% children who are breastfed at some point. [1]

For mothers to have better breastfeeding, traditionally galactagogue are used. Galactagogue are substances that promote lactation in humans which are foods that increase or promote the flow of a nursing mother. Along with the consumption of galactagogues the mother should be stress free, which will help her to release oxytocin for exclusive breastfeeding. In the present study, laddu was made using ingredients like jaggery, pumpkin, flax, sesame, lotus and chia seeds and dink, suwa, ajwain, fenugreek powder as galactagogue. In Indian tradition, galactagogue consumption is still observed today.

The objective of the study is

- 1) To standardize an innovative traditional nutritious product this is also cost effective as per the acceptance of consumer.
- 2) To cater to working and mothers in nuclear family, to avail traditional and nutritional galactagogue for exclusive breastfeeding.
- 3) To study the shelf life of the product using sensory evaluation.
- 4) To design an innovative nutritional label.
- 5) Packaging of the product.
- 6) To understand the budgeting and marketing aspects of product development and to develop entrepreneurship skills.

A food product had to be designed and developed under the course “Food Product Development” in the under graduate third year studies. Based on the small survey conducted, we found out that the nursing mother faced problem complaining about insufficient milk for their infant. The nutritious laddu was developed for lactating mother to increase breastmilk production. The product lacto munchies was finalised based on the consumer acceptability and sensory evaluation. The product provides good amounts of biological proteins, functional property, vitamins and minerals, adequate fibre and has a good satiety value. [2]

Fenugreek- Reports of the successful use of fenugreek as a galactagogue have been documented as far back as 1945 making it the best known and most widely use galactagogue. [4] Its uses include as a treatment of weakness and leg oedema, as a lactation and appetite stimulant. [12]

Makhana- The nutritional value of makhana is attributed its high fibre content, low glycemic index and phytochemical constituents. It is low in calories. Its fibre content acts as an absorbent. [15]

Dink- Dink or edible gum is known to be beneficial for pregnant ladies as it strengthens back bone. [11]

Ajwain- In a study it was revealed that protein, fibre and ash contents were maximum in Ajwain (omum seeds). The total Ca, Fe, Zn, Cu and P was also highest in Ajwain. The available minerals were also higher in Ajwain as compared to other foods. [7] It is used traditionally as an important remedial agent for flatulence, atonic dyspepsia, diarrhoea, abdominal tumours, abdominal pains, piles, and bronchial problems, lack of appetite, galactagogue, asthma and amenorrhoea. [8]

Dill seeds (Suwa) - Dill is a relaxant, and it increases strength and urination to help in the removal of toxins, excess salts, and water from the body. It stimulates lactation (galactagogue) and it ensures bone and dental health since it is a good source of calcium. [19]

Sesame seed - Large, black sesame seeds are used to increase milk production across Asia.

Husked, light-coloured sesame seeds are also effective and easier to digest. [3]

Chia seed- This seed is a natural source of omega-3 fatty acids (α -linolenic acid), soluble and insoluble fibres, and proteins in addition to other important nutritional components, such as vitamins, minerals, and natural antioxidants. [6]

Flaxseed- Flaxseed provides a non-absorbable fibre which has been used as a laxative and has also been used topically to treat various skin conditions. Flaxseeds used by the nursing mother as a laxative or topical poultice are not expected to adversely affect the breastfed infant. [17]

Milk powder- Milk powder contains all twenty-one standard amino acids, the building blocks of proteins, and is high in soluble vitamins and minerals. According to USAID, the typical average amounts of major nutrients in the reconstituted non-fat dry milk are (by weight) 36% protein, 52% carbohydrates (predominantly lactose), calcium 1.3%, and potassium 1.8%. [14]

Oats- The humble oat is one of our most nutritious foods, and contains proteins, vitamins, minerals and trace elements that nourish the nerves, support the metabolism of fats, and uplift the spirit. [3]

Cinnamon - The dried, aromatic bark of an evergreen of the laurel family, native to Ceylon. Cinnamon is used in the form of quills, bark and powder. It has keeping qualities. [1]

MATERIALS

Materials used to prepare this product in trail 1 are:

Table 1	
Ingredients	Amount (gms)
	Trial 1
Jaggery	180
Ghee	30
Cornflakes	30
Oats	30
Almonds	20
Peanuts	20
Grated coconut	15
Chia seeds	0
Sesame seeds	15
Dink (gum arabic)	10
Makhana	10
Rice crispies	10
Milk powder	10
Suwa powder	10
Pumpkin seeds	10
Flax seeds	10
Methi powder	5
Ajwain powder	5
Cinnamon	5

As can be observed from Table 1 the munchies were tried out with the given ingredients. The dry ingredients were roasted and mixed with melted ghee and jaggery and it was given a shape of a laddu. The consumer acceptability test was carried out for this product and it was not accepted by the consumer as the texture was rock hard. It was then modified adding more ghee, jaggery and other ingredients.

STANDARDISATION

The recipe which was modified and standardised is given in Table 2:

Table 2	
Ingredients	Amount (gms)
	Trial 2
Jaggery	220
Ghee	50
Cornflakes	50
Oats	50
Almonds	20
Peanuts	20
Grated coconut	15
Chia seeds	15
Sesame seeds	15
Dink (gum arabic)	10
Makhana	10
Rice crispies	10
Milk powder	10
Suwa powder	10
Pumpkin seeds	10
Flax seeds	10
Methi powder	5
Ajwain powder	5
Cinnamon	5

In the standardised recipe, the amount of jaggery, ghee, cornflakes and oats were modified. Addition of chia seeds in the recipe was done because of its nutritional benefits. There are no preservatives used in the making of lacto munchies.

METHOD AND PREPARATION

Weigh all the ingredients



Shallow fry the dink (gum arabic) with ghee



Roast all the dry ingredients separately



Crush the makhana and cornflakes



Melt ghee with jaggery

(jaggery syrup)



Mix all the remaining ingredients with jaggery syrup



Let it cool down for a minute; give it a laddu shape

Special tips to be followed

- Melt jaggery on a low flame to avoid change in colour and burnt flavour.
- Do not allow it to cool for more than a minute as it won't take the shape of laddu.
- Do not reheat the mixture once taken off the flame.

SENSORY EVALUATION FOR SHELF LIFE STUDY

Sensory analysis (or sensory evaluation) is a scientific discipline that applies principles of experimental design and statistical analysis to the use of human senses (sight, smell, taste, touch and hearing) for the purposes of evaluating consumer products. [16]

In order to study the shelf life of the product, sensory evaluation was done periodically for four weeks. For the evaluation, scoring test with a seven-point scale was used which was done by 12 semi-trained panel members. Characteristics evaluated were colour, taste, texture, after taste, and overall acceptability; where,

1 = dislike extremely

2 = dislike very much

3 = dislike slightly

4 = neither like nor dislike

5 = like slightly

6 = like very much

7 = like extremely

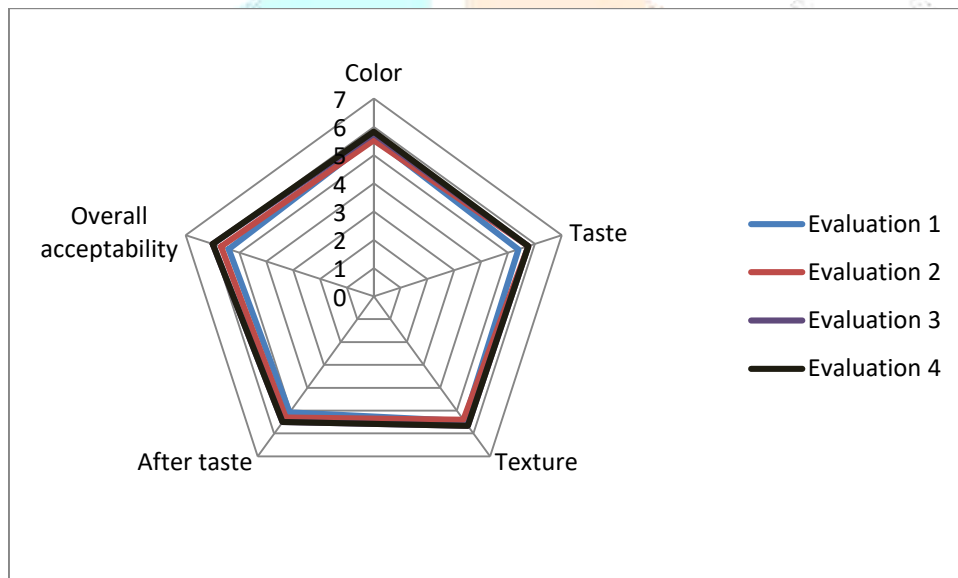


Figure 1: Sensory Evaluation

The sensory parameters did not deviate much for all the 4 sensory evaluation. The product was found to be highly acceptable and was scored between 5 and 6 score i.e. like slightly and like very much.

NUTRITIONAL LABEL

Functional foods that are approved for marketing must be labelled according to standards promulgated under the labelling regulation for conventional food. [9] Nutritional label informs the consumers about the nutrient content of the food. Nutrition information on food labels could be a cost-effective method of communicating nutrition information to consumers because the information appears at the point of sale for most packaged foods. [10]

In general, the label requires inclusion of the product name, list of ingredients, net content, manufacturing date, expiry date, batch no., MRP, vegetarian or non-vegetarian marks, information and contact of the manufacturing and marketing bodies, special recommendation and storage information. The label should be truthful and not mislead consumers. It should also be eye catching and attractive to improve sales.

Table 3:

Nutrition Facts	
Serving Size: (40g)	
Amount per serving	
Calories 170	
% Daily value*	
Total Fat 6g	9%
Saturated Fat 2.5g	13%
Trans Fat 0g	
Cholesterol 5mg	2%
Sodium 35mg	1%
Potassium 75mg	2%
Total Carbohydrate 27g	9%
Dietary Fibre 3g	12%
Sugars 9g	
Protein 3g	6%
Vitamin A 0%	Vitamin C 0%
Calcium 20%	Iron 10%
Vitamin E 4%	Vitamin B6 4%
Folate 4%	Magnesium 6%
Zinc 4%	Selenium 2%



PACKAGING MATERIAL

Increased environmental concerns over the use of certain synthetic packaging and coatings in combination with consumer demands for both higher quality and longer shelf life have led to increased interest in alternative packaging materials research. [5] So, instead of synthetic or polythene packaging recyclable polymers can be used. A stand-up pouch made from kraft material that is laminated to other layers of film IS recyclable and landfill friendly. To be clear, kraft — once it is laminated — is NOT biodegradable, but it is recyclable. [18] For the packaging of Lacto Munchies, chocolate foil was used to wrap the laddu and was then packed in Zip lock stand up

pouch made with kraft material with inner polythene lamination. The lamination retards unwanted moisture transfer in food products, are good oxygen and oil barriers and keeps the product fresh.



BUDGETING

Budgeting is an important aspect to be considered in food product development. It makes it easier for people with incomes and expenses of all sizes with conscious decisions about the allocation of money. For bulk production food items were brought from wholesale market to reduce the cost.

Table 4:

Materials	Cost
Jaggery	13.2
Dink (gum Arabic)	25
Methi powder	2
Makhana	10
Grated coconut	1.2
Rice crispies	4
Ajwain powder	2
Ghee	21.27
Chia seeds	9.5
Sesame seeds	1.4
Milk powder	5
Corn flakes	3.5
Suwa powder	2
Cinnamon	5
Peanuts	2.5
Almonds	16
Pumpkin seeds	5.4
Flax seeds	0.8
Oats	5
Packaging material	40
Labelling	40
Other Expenses	130
Total	344.77

The cost of 1 packet = Rs.26/- for 40gm but would be sold at Rs. 30/- with the profit of Rs. 4/- per packet.

MICROBIAL AND CHEMICAL ANALYSIS FOR SHELF LIFE STUDY

Microbial analysis was done on the first week and fourth week after packing Lacto munchies. Pour plate method was used using nutrient agar. The Laddo was diluted twice and 1ml of each diluted sample was poured in two different petri dishes with nutrient agar. The petri dishes were incubated for 24hours at 37 degrees.

Table 5:

Microbial analysis for 1st week

DILUTIONS	NUMBER OF COLONIES
10 ¹	5
10 ²	3

Table 6:

Microbial analysis for 4th week

DILUTIONS	NUMBER OF COLONIES
10 ¹	7
10 ²	4

From table 5 and 6, the number of colonies formed in the 1st and 4th week were in the acceptable range. Hence, the product Lacto munchies was proved to be safe for consumption upto the period of 1month.

For chemical analysis, the moisture percentage was analysed. For the analysis a crucible was weighed (W) after which 5gms of sample was weighed. The crucible was kept in the muffle furnace for 24hours, the crucible was weighed and the reading was taken. After the 1st reading, the crucible was kept in the muffle furnace for 4 hour and weighed till 3 constant readings were obtained.

Weight of crucible (W) – 18.13g

Weight of crucible + weight of sample (W₁) – 18.13 + 5g = 23.13g

Constant reading (W₂) – 22.64g

Table 7:

	Readings
1 st reading after 24hours	22.65 g
2 nd reading after 4hours	22.64 g
3 rd reading after 4hours	22.64 g
4 th reading after 4hours	22.64 g

$$\text{Calculation: moisture \%} = \frac{100(W_1 - W_2)}{(W_1 - W)}$$

$$= \frac{100(0.49)}{5}$$

= 9.8% moisture

CONCLUSION

Lacto Munchies is a product providing variety of nutrients like calcium, iron, fibre, protein and energy. This product is mainly designed and developed for nursing mothers to help them breastfeed their babies to the fullest and can be consumed by all age groups (except pregnant woman as it contains flax seeds) due to its high nutritional value. The main objective for developing lacto munchies was to help the working mothers as well as the mothers in nuclear family to be able to consume traditional and nutritional galactagogue for exclusive breastfeeding. The results of microbial analysis of the product proved to be safe for consumption upto the period of 1 month and for improving the shelf life of the product addition of class-I preservatives may prove to be helpful.

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