NUTRITIVE VALUE AND SENSORY EVALUATION OF VALUE ADDED PRODUCTS DEVELOPED BY INCORPORATING DRIED HARSHRINGAR (*NYCTANTHES ARBOR – TRISTIS)* LEAF POWDER

RITU MATHUR, BHARTI JAIN and ARCHANA SHARMA

Department of Food Science and Nutrition , MDS University , Ajmer 305009 Rajasthan , India.
Corresponding Author Email:drritumathur@gmail.com

Harshringar is an ancient plant native to South Asia and South East Asia which has religious and medicinal significance. It is known by several names such as "Parijata" " Shefali" the " Night Flowering Jasmine", " Hengra Bubar", "Shivli" the "Tree of sorrow" and its botanical name is *Nyctanthes arbor – tristis* . Its flower is the official flower of West Bengal. *Nyctanthes arbor – tristis* grows as a shrub or a small tree which grows about 10 meters or up to 33 feet tall with a flaky grey bark. The leaves are simple, opposite, 6 to 12 cm long and to 2 -6.5 cm broad with an entire margin. The leaves have been used in Ayurvedic medicine and Homeopathy for sciatica, arthritis, in fever, as an anti-inflammatory agent and as a laxative. The present study was undertaken to assess the nutritive value and the sensory evaluation of two popular snacks (value added products) namely Mathri and Meetha shakarpara incorporated with 2 per cent and 3 per cent Dried Harshringar Leaf Powder (DHLP) .The results of nutritional composition studies revealed that the standard Mathri had a Protein content of 10.57% , Carbohydrate 64.17% , fat , 41.53 % , Fibre 11.36%, Ash 1.28% and Energy 680 kcal per 100 gm. The nutrient composition of Meetha Shakarpara was Protein content of 10.57% , Carbohydrate 139.17% , fat , 41.53 % , Fibre 11.36%, Ash 1.28% and Energy 980 kcal per 100 gm. The results of the mean score of organoleptic characteristics of Mathri developed by incorporating 2% and 3% of the DHLP 8.1 ± 1.3 and 9.0±1.42 for colour respectively, 8.0±1.06 and 9.0±0.99 for appearance, 13.0±1.49 for texture (for both 2% and 3% incorporation with DHLP) and 13.0±2.18 and 13.0±8.1 for taste at 2% and 3% levels respectively. The overall acceptability for standard Mathri was 92%, for Mathri incorporated with 2% and 3% DHLP was 84.2% and 88% respectively. The results of organoleptic characteristics of Meetha Shakarpara developed by incorporating 2 % and 3% DHLP were 8.85±1.95 and 8.92±1.96 for colour respectively, 9.47 ±1.38 and 8.80±1.75 for appearance, 13.25 ± 1.88 and 12.77± 1.78 for texture and 13.50 ± 1.80 and 11.93± 1.74 for taste at 2% and 3% levels respectively. The overall acceptability of Standard Meetha Shakarpara was 92.7% and for Meetha Shakarpara incorporated with 2% and 3% DHLP was 90.14% and 84.84% respectively. A comparative evaluation of the two snacks shows that the overall acceptability of Meetha Shakarpara at 2% was the highest followed by Mathri at 3% , then Meetha Shakarpara at 3% followed by Mathri at 2% levels. Hence in conclusion it can be said that Harshringar dried leaf powder can be used in popular Indian snacks with a great degree of safety and palatability, its addition enhances the nutritive value of snacks and can be used as a therapeutic powder for the prevention and management of several chronic degenerative diseases.

Keywords: Harshringar leaves, value added products, nutritional composition, sensory evaluation, organoleptic characteristics, acceptability

Introduction

India is a land of rich biodiversity with an appreciable heritage of medicinal plants. *Nyctanthes arbor – tristis* linn belongs to the family   *Oleaceae*, *Nyctanthaceae* , kingdom *plantae* , division *Magnoliophyta* , Class *Magnoliopsida* , Order *Lamiales* .It is known by various names such as in Hindi - Harshringar , in Sanskrit and Kannada - Parijatha, in Marathi - Parijathak, in English - Tree of Sorrow, Night Jasmine and Coral Jasmine and in Ayurvedic medicine – Paarijaata,   Shephaali , Shephaalika, and Mandaara etc. .The flowers emit a very strong and pleasant fragrance during the whole night and start falling after midnight or at the break of the day [1&2] . The botanical/ generic name of the plant has been coined from two Greek words "*Nykhta*" which means night and "*Anther*" which means flower [3&4] . The specific name "*Arbor tristis*" means the sad tree due to the dull looks of the tree during the day time. The plant is laden with phytoconstituents all of which are beneficial for health .

The leaves of *N. Arbor tristis* contain D-Mannitol, Beta – sitosterol , flavonol glycosides, astragalin , nicotiflorin , oleanolic acid, nyctanthic acid , tannic acid , methyl salicylate , an amorphous resin , traces of volatile oil, carotene , friedeline , lupeol , mannitol ,glucose , fructose , iridoid glycosides and benzoic acid[6-10]. The leaves of *Nyctanthes arbor – tristis* are used in Ayurved to cure several diseases such as chronic fevers[11] , rheumatic diseases, sciatica pain, worm infections and as a diuretic , laxative and diaphoretic[12] Similarly the flowers , seeds , bark , stem , the flower oil and the plant are laden with phytochemicals and several chemical constituents with therapeutic properties[5]. Thus the plant is of immense medicinal importance. The present research study was undertaken with the following objectives:

1. To develop value added products by incorporating DHLP into popular Indian snacks viz. Mathri and Meetha Shakarpara
2. To conduct Sensory evaluation studies on semi trained panel members regarding the acceptability of these snacks.
3. To estimate the nutritive value and cost of these two snacks.

Material and Methods

The study was conducted in the following five phases:

Phase I – Collection of fresh leaves of *Nyctanthes arbor- tristis* and shade drying them and grinding them to convert into powder form to obtain Dried Harshringar Leaf Powder (DHLP).

Phase II – Standardisation of recipes of Mathri and Meetha Shakarpara and developing value added products viz. Mathri and Meetha Shakarpara incorporating DHLP at 2% and 3% levels in both the recipes.

Phase III – Selecting panel members for Sensory Evaluation through Threshold Tests.

Phase IV – Sensory Evaluation of Mathri and Meetha Shakarpara (Standard recipe and recipes with 2% and 3% DHLP).

Phase V- Data compilation, interpretation and analysis.

Phase I: Collection of leaves

The tender fresh leaves of Harshringar were collected , sorted , washed with clean water and shade dried for 10 days. They were ground to a fine powder , sieved and then stored in an air tight container.

Phase II: Standardisation of basic recipes of Mathri and Meetha Shakarpara and developing value added Mathri and Meetha Shakarpara incorporating DHLP at 2% and 3% levels .

A recipe is a formula in which measured ingredients are combined in a specific proportion in a specific procedure to give pre-determined results. A standardized recipe is one that has been tried , adapted and retried several times to produce the same good result and yield using exactly the same procedure and equipment each time with the same quantity and quality of the ingredients. These recipes have the advantage of being constant in terms of cost, quality, composition and nutritive value. The standardized recipes also save time , reduce wastage and make the procedure simple and accurate.

S.No.	Ingredients	Amount (in gm.)
1	Wheat flour (whole)	100
2	Oil (for dough preparation)	15
3.	Salt	4
4.	Ajwain	3
5.	Oil (used for frying)	25

Table 1: Recipe of Standard Mathri

Method of Mathri preparation:

- Whole wheat flour was taken in a bowl. In this salt, oil and ajwain were added and mixed well.
- Water was added to knead the flour into a hard dough
- The dough was divided into 15 equal sized balls and rolled to half cm thickness and about 5 cm. diameter
- The Mathri were deep fried on medium heat till golden brown and crisp

Total serving – 15 pieces

Cooking Time – 20 minutesS.No.	Ingredients	Mathri with 2%DHLP (in gm.)	Mathri with 3%DHLP (in gm.)
1	Wheat flour (whole)	98	97
2	DHLP	2	3
3.	Oil (for dough preparation)	15	15
4.	Salt	4	4
5.	Ajwain	3	3
6	Oil(used for frying)	25	25
Method, total serving and cooking time is that of standard Mathri			

Table 2 : Recipe of Mathri incorporating DHLP at 2% and 3% levels

S.No.	Ingredients	Amount (in gm.)
1	Wheat flour (whole)	100
2	Ghee (for dough preparation)	15
3	Sugar	75
4.	Ghee (used for frying)	25

Table 3 : Recipe of Standard Meetha Shakarpara

Method of preparation of Meetha Shakarpara:

- Whole wheat flour was taken in a bowl, melted ghee was added to it and it was mixed well.
- Water was added to knead it into a smooth dough
- The dough was rolled into a large circle. The circle was cut into equal sized shakarpara.
- Ghee was heated in a kadhai and shakarpara were deep fried on medium heat till golden brown. These were kept aside
- Sugar syrup was prepared by heating sugar and water in a pan.
- To check the consistency of the sugar syrup a few drops were taken in a bowl and the placed between the finger and the thumb , if there was the formation of a long thread while stretching the fingers apart , the sugar syrup was considered ready and the flame was turned off.
- The shakarpara were added in the syrup and tossed swiftly to ensure an equal coating on the surface of the shakrpara.

Total Serving – 30 pieces
Cooking Time – 30 minutes

S. No.	Ingredients	Meetha Shakarpara with 2%DHLP (in gm.)	Meetha Shakarpara with 3%DHLP (in gm.)
1	Wheat flour (whole)	98	97
2	DHLP	2	3
3.	Ghee (for dough preparation)	15	15
4.	Sugar	75	75
5.	Ghee (used for frying)	25	25
Method , total serving and cooking time – same as that for Standard Meetha Shakarpara.			

Table 4 : Recipe of Meetha Shakarpara incorporating DHLP at 2% and 3% levels

Phase III : Selecting Panel Members for Sensory Evaluation through threshold Tests

A panel of 30 members were selected on the basis of a Threshold test. For this purpose five dilutions of different concentrations of salt and sugar samples were prepared. The dilutions were served randomly to the panel members who were asked to rank the solutions in the correct increasing order of salinity and sweetness.

Solution No.	Sweet Taste		Salty Taste	
	Description	Score	Description	Score
A				
B				
C				
D				
E				
F				

Table 5: Sensitivity Threshold Taste

Phase IV : Sensory Evaluation of Mathri and Meetha Shakarpara (Standard Recipe and recipes with 2% and 3 % DHLP)

Sensory evaluation is a combination of different senses of perception which come into play for choosing and eating a food or it can be defined as a scientific discipline used to evoke, measure , analyse amd interpret results of those characteristics of food as they are perceived by the senses of sight , smell , taste and touch1[3]. Therefore the sensory qualities were evaluated by a panel of judges selected as in Phase III for ensuring the acceptability of the products. Scoring is the most frequently used method of sensory testing of food for quality. The diversity and simplicity of score cards are the primary reasons for their widespread use. Score Cards provide a numerical standard by which several quality parameters can be measured. Food quality is the composite of the characteristics that differentiate the individual units of a product and that have a significance in determining the degree of acceptability of that unit by the user.

Development of score card: Score Cards were developed for evaluating the value added products viz. Mathri and Meetha shakarpara for sensory qualities like color , taste, texture , appearance and overall acceptability. Composite rating scale and Hedonic Rating scale were used for rating the sensory attributes for each of the products. For the present study , to assess the acceptability of the two snacks , thirty judges were selected who were post graduate students of the Department of Botany and Food Science and Nutrition aged between 21-25 years.

Description	Weak Taste	Medium	Strong	Very strong	Extremely strong
Scales of Score	1	2	3	4	5

Table 6: Intensity Scale For different Primary Tastes

Name of the recipe:
Name of the Respondent:
Designation:
Date:

S.No.	Sensory Attribute	Weightage	Maximum Score	Sample A	Sample B	Sample C
1.	Colour	2	10			
2.	Appearance	2	10			
3.	Texture	3	15			
4.	Taste	3	15			
5.	Overall acceptability	10	50			

Five Point Rating Scale: 5-Very Good,4 - Good,3- Fair,2- Bad,1-Very Bad

Table 7: Sample of a Composite Score Card using Five Point Rating Scale for Mathri / Meetha Shakarpara

Method of Sensory Evaluation : The method requires great concentration on the part of the panel members. Disturbances such as noise, off odours etc. were avoided

during the entire time period. Coded samples were presented to panelists with Score Cards for evaluating the products and the degree of acceptability for each characteristic to be tested. Samples were presented in a uniform manner without disclosing the standard / DHLP incorporated recipes. A glass of water was served to avoid intermingling of the taste of two samples and to ensure proper evaluation.

Composite scoring Test: The products were judged organoleptically by the subjects using a Composite Scoring Test in which points were assigned separately for colour , taste , texture , appearance and overall acceptability. The rating scale was so defined that a specific characteristic of a product was rated separately and the most important characteristic would account for a large part of the total score. The five point rating scale is used to measure the consumer acceptability of food products.

Phase V:Data compilation , interpretation and analysis
The nutritive value and total cost of the recipes were calculated. The mean scores for all the quality characteristics and the overall acceptability were calculated. The data was tabulated and analysed for deriving the results.

Results and Discussion:
The results of the present study have been discussed under the following three headings:
1. Nutritive value of the recipes
2. Cost of the recipes
3. Sensory evaluation of recipes

1.Nutritive value of the recipes:
The nutritional composition of the recipes selected for the present piece of research viz. Mathri and Meetha shakkarpara was calculated according to the Indian Food Composition Tables[14].

Name of the Product	Protein (gm)	Ash (gm)	Fat (gm)	Fibre (gm)	CHO (gm)	Energy (k.cal.)
Standard Mathri	10.57	1.28	41.53	11.36	64.17	680
Standard Meetha Shakarpara	10.57	1.28	41.53	11.36	139.17	980

Table 8 : Nutrient Composition of Standard Mathri and Standard Meetha Shakarpara

The nutritional composition of standard Mathri revealed protein content of 10.57% , fat 41.5 %, carbohydrate 64.1 7%, fibre 11.36%,ash 1.2 8% and energy value of 680 kilo calorie per 100 gram. The incorporation of DHLP enhanced its nutritive value in terms of phytochemicals, carotenoids, glycosides and ascorbic acid, all of which serve as important antioxidants and immune boosters.

The nutritional composition of standard Meetha Shakarpara revealed protein content of 10.57%, fat 41.53%, carbohydrate 139.17% , fibre 11.36% , ash 1.28 % and energy value of 980 kilo calorie per 100 gram . As has been mentioned for the Mathri incorporated with DHLP, the Meetha Shakarpara with DHLP was

nutritionally superior in terms of having an enhanced value of micronutrients, phytoconstituents and important glycosides.

2. Cost of the recipes:
The cost of the recipes was calculated according to prevailing rates of the food items and the amount of individual ingredients used in the preparation .The cost of standard Mathris made with 100 gram whole wheat flour was 9.60 rupees and that of standard Meetha shakkarpara made with 100 gm. of wheat flour was 26.80 rupees.

3. Sensory Evaluation of the Recipes:
The scores obtained for the organoleptic characteristics of the two value added products viz. Mathri and Meetha shakkarpara were tabulated and the results obtained have been discussed.

Value Added Mathri	Colour (10)	Appearance (10)	Texture (15)	Taste (15)	Overall acceptability (50)
Mathri (Standard)	9.0 ± 0.86	9.0 ± 0.98	14.0±1.86	14.0±1.47	46.0±1.23
Mathri with 2% DHLP	8.1 ± 0.13	8.0 ± 1.06	13.0±1.49	13.0±2.18	42.1±1.40
Mathri with 3% DHLP	9.0 ± 1.42	9.0±0.99	13.0±1.49	13.o±8.1	44.0±1.39

Table 9: Mean Scores obtained for Organoleptic Characteristics of Standard Mathri and Mathri developed by incorporating 2% and 3% Dried Harshringar Leaves Powder (DHLP)

The mean scores obtained for the organoleptic characteristics of Mathri were as follows- the scores for colour of Mathri were 9.0 ± 0.86, 8.1 ± 0.13 and 9.0 ±1.42 for standard, 2% DHLP and 3% DHLP Mathris respectively (Table 9) .The appearance of standard Mathri and 3% DHLP were equally rated at 9.0± 0.98 and 9.0 ±0.99 respectively whereas 2% DHLP Mathri had scores for appearance at 8.0± 1.06. The texture scores of standard Mathri were the highest (14.0±1.86) followed by 13.0 ± 1.49 for both 2% and 3% DHLP Mathri. The score for taste was the highest for standard Mathri (14.0 ±1.47) and the same taste scores were assigned to 2% and 3% DHLP Mathri (13.0 ± 2.18 and 13.0

±8.1 respectively). The overall acceptability was the the highest for standard Mathri (46.0± 1.23), followed by acceptability at 3% DHLP (44.0 ±1.30) and then at 2% DHLP was 42.1±1.40 (Table 9). The results indicated that DHLP can be incorporated at 2% and 3% level in Mathris without having a major adverse impact on colour , appearance, taste, texture and overall acceptability. The 3% DHLP Mathris were found to be more acceptable than the 2% DHLP ones. The   overall acceptability scores for standard Mathri and Mathri incorporated with 2% DHLP and 3% DHLP were 92%, 84.2% and 88% respectively (Fig. 1).
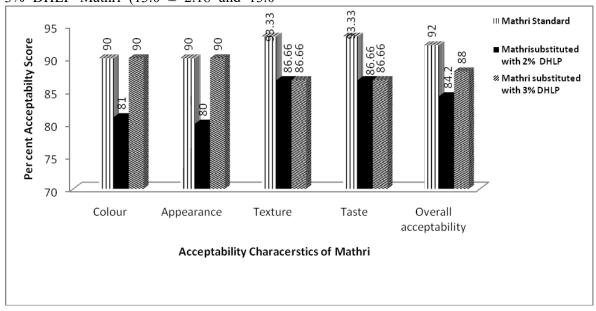

Fig. 1: Per cent acceptability scores of the Mathri developed from Dried Harshringar leaves powder (DHLP)

Value Added Meetha Shakarpara	Colour (10)	Appearance (10)	Texture (15)	Taste (15)	Overal l accept ability (50)
Shakarpara (Standard)	9.49 ± 1.90	9.27 ± 1.09	13.89± 1.64	13.70 ± 1.94	46.35 ± 1.60
Shakarpara substituted with 2% DHLP	8.85 ± 1.95	9.47 ± 1.38	13.25 ± 1.88	13.50 ± 1.80	45.07 ± 1.73
Shakarpara substituted with 3% DHLP	8.92 ± 1.96	8.80 ± 1.75	12.77 ± 1.78	11.93 ± 1.74	42.42 ± 1.74

Table 10:Mean Scores obtained for Organoleptic Characteristics of Standard Meetha Shakarpara and Meetha Shakarpara developed by incorporating 2% and 3% Dried Harshringar leaves powder (DHLP)

The mean scores obtained for the organoleptic characteristics of Meetha shakarpara revealed that the scores for colour were 9.49 ± 1.90, 8.85 ± 1.95 and 8.92 ±1.96 for standard, 2% DHLP and 3% DHLP Meetha Shakarpara respectively (Table 10). The best texture scores were assigned for the standard Meetha Shakarpara (13.89±1.64),followed by Meetha Shakarpara with 2% DHLP (13.25±1.88), followed by Meetha Shakarpara with 3% DHLP (12.77±1.78). similarly for the taste, the highest scores were assigned for the standard (13.70±1.90) followed by score for Meetha Shakarpara with 2% DHLP (13.50 ± 1.80) and then followed by score for Meetha Shakarpara with 3% DHLP (11.93±1.74). The overall acceptability was the highest for the standard Meetha Shakarpara (46.35± 1.60). This was followed by acceptability score of Meetha Shakarpara with 2% DHLP (45.07±1.73) and then the score of 42.42±1.74 with 3%DHLP. The results indicate that DHLP is more acceptable in Meetha Shakarpara at the 2% level as compared to the 3%level. The overall acceptability scores for standard Meetha Shakarpara and Meetha Shakarpara incorporated with 2% DHLP and 3% DHLP were 92.7%, 90.14% and 84.84% respectively (Fig. 2)
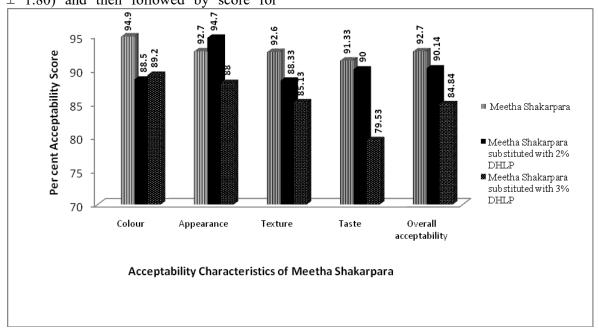

Fig. 2: Per cent acceptability scores of Meetha Shakarpara developed from Dried Harshringar leaves powder (DHLP)

Conclusion :

In conclusion it can be said that Harshringar levels are safe to use, they are non toxic and they have multiple health benefits. Research reveals that their antioxidant properties and rich content of phytonutrients can prevent several chronic diseases like cardiovascular diseases , arthritis and cancer. To encourage the use of consumption of DHLP nutritionist promote the development of value added products. The present study proves that the addition of DHLP in popular Indian snacks like Mathri and Meetha shakarpara enhanced its nutritive value and was well accepted with respect to all the organoleptic characteristics used for sensory evaluation. Hence it can be recommended for use in other snacks/ recipes to yield healthy and nutritious food for a wide consumption among different segments of the population.

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