



Nutritional Evaluation of Giloe (*Tinospora cordifolia*) Extract Incorporated Energy Dense Food Products

* Dr. K Geeta ** Dr. Kumari Sharda

* Assistant Professor, Food and Nutrition, Institute of Home Economics, Hauz Khas enclave, University of Delhi.

** Programme Coordinator, Krishi Vigyan Kendra, Bihar Agriculture University, Sabour, Arariya-854311.

ABSTRACT

In this study efforts have been made to evaluate the acceptability potential of value added energy dense indigenous products. Fresh, natural stem of Giloe was used to get its white powder which contains several bioactive components responsible for pharmacodynamic properties. Giloe extract was incorporated at the level of 1%, 2%, 3% and 4% level in the energy dense indigenous products Laddu and Mathari. Analysis of results showed that there is no significant difference ($p < 0.05$) in bitterness or sweetness exist among the four levels of incorporations in Laddu. All levels of incorporation showed same level of closeness to reference product. In case of Mathari, result showed that sample with 4% of Giloe extract was significantly bitter ($p < 0.05$) than the rest. No significant difference was found in the bitterness among the samples at 1%, 2%, and 3% level and these products showed same level of closeness to the reference product. Thus, these value added products can be used to utilize the ethno medicinal properties of Giloe in improving nutritional status of the society.

Keywords : Giloe extract, value added product, energy dense indigenous product

Introduction

As per the recent report by NFHS, large sections of our population especially women and children are malnourished. They not only face the debilitating consequences of nutritional deficiencies in their day to day life but also subject their future generation into the vicious cycle of malnutrition. Modern health care systems are not proving to be sufficient to face the challenges of malnutrition due to various known and unknown reasons. Alternative health care with cheaper and conveniently available resources might make the difference.

In recent times, focus on plant research has increased all over the world and large body of information and evidence has been generated to show immense potential of medicinal plants used in various traditional systems. To cope with increasing demands for food and medicines steps are being taken to discover and populate important economic plants with proven food and medicinal efficacies. 'Giloe' is one such plant which is a valuable source of medicine and food which exhibits unique immune stimulating, anti-inflammatory, anti-oxidant and stimulator of bile secretion property (Badar et al. 2005; Bafna and Balaram 2005; Nair et al. 2004; Singh et al. 2006;). In Ayurvedic system of medicine, it is used to strengthen immune system and to keep the function of various organs in harmony (Singh et al. 2003). Water extract of Giloe contains a glycoside giloin, a non glycoside bitter gilenin and a glosteral. These active principles are responsible for the pharmacodynamic properties of Giloe (Pendse et al. 1977).

Traditionally, stem extract of Giloe is used with whey, haldi, jaggery and also with black pepper to cure various ailments. In some parts of the country special vegetables are prepared from Giloe leaves. Giloe being bitter in taste is not liked by all sections of population and inhibits its use in the diet on regular basis. The present study therefore was planned and carried out with the objective of preparing nutrient dense indigenous food products incorporating Giloe extract to utilize its ethno medicinal potential in improving nutritional status.

Materials and Methods

Aqueous extract

Fresh, natural stems of Giloe were collected from locally available resources. The Giloe stems were thoroughly washed with tap and distilled water to remove adhering impurities. These stems were cut into small pieces and disintegrated in a waring blender with small quantity of water and then churned for about 15 min. with equal amount of distilled water. The slurry was then allowed to leach for one hour. After one hour the fluid was strained and refrigerated overnight. White powder like extract settles down. This powder was removed, sun dried and stored for chemical analysis and incorporation in food products (Mehra and Puri 1969).

Nutrients analysis of the extract

The water extract was analyzed for moisture, protein, fat, total ash, crude fiber and minerals (calcium, phosphorus and iron) using standard techniques. For moisture estimation, 10gm sample was weighed and kept in oven at 100°C for 12 hours (Raghuramulu et al., 2003). Protein was estimated by Lowry's method (Raghuramulu et al., 2003). A mixture of ethyl ether and ethanol in the ratio of 3:1 was used to extract the fat. Estimation of ash and crude fibre was carried out by the method given in the manual of laboratory techniques (Raghuramulu et al., 2003). Calcium estimation was done by titrimetric method and iron by Wong's method. Phosphorus was estimated by Fiske and Subba Row method. Carbohydrate content of the sample was determined as a difference of the weight of the sample and sum of values of moisture, crude protein, fat, ash and crude fibre from. Energy content was calculated by multiplying physiological values of protein, fat and carbohydrate i.e., 4, 9 and 4 cal respectively with the obtained values of protein, fat and carbohydrate of the sample.

Product selection and incorporation of Giloe extract

Based upon the popularity and acceptability, two indigenous food products Laddu and Mathari were selected for the present study. For preparation of Laddu, ingredients used were

semolina (24%), wheat flour (24%), dry coconut powder (4%), sugar (24%) and vegetable oil (24%). Incorporation of Giloe extract was done in place of wheat flour at all the four levels (1, 2, 3, and 4 percent). Wheat flour and semolina were roasted in heated oil. Dry coconut powder was added when the flour was golden brown. After cooling the ingredients, powdered sugar and giloe extract was mixed and even size round ball (laddu) was prepared. Laddu without incorporation of Giloe powder was considered as reference/control product.

Mathari was prepared by using refined wheat flour (45%), semolina (15%), salt (as per taste, approximately 1 percent) and vegetable oil (40%). Giloe extract at all the four levels (1, 2, 3, and 4 percent) was added in place of refined wheat flour. All the ingredients wheat flour, semolina, salt and one third of oil was mixed and dough was made. The pulverized Giloe extract was also added at the time of dough making to mix it uniformly. Dough was given flat round shape and deep fried in oil till golden brown colour. Mathari without Giloe incorporation was prepared to serve as reference/control.

Sensory evaluation and nutrient analysis of the product

The panel members were selected using triangle test. Nine point hedonic scale was used to test the acceptability of the reference products Laddu and Mathari for different attributes viz. appearance, taste, overall acceptability and after taste. Incorporation of Giloe extract at various levels in food products were tested for its bitterness by using Multiple Comparison Test. Prepared food products (reference/control) were analyzed for their moisture, protein, total ash, crude fibre and mineral (calcium, phosphorus and iron) content with same standard techniques used for Giloe extract. Energy and carbohydrate content was calculated as in case of the Giloe extract.

Results and Discussion

Giloe extract and its Nutrient composition

In Ayurvedic system of medicine, Giloe is referred as one of the most versatile rejuvenating herb. Giloe extract powder which is used traditionally as tonic in some part of the country was made according to the standard process followed by the practitioners. The recovery was found to be 1.2% which is lower than to the recovery found by Mehra et al (1969). The moisture content of Giloe extract was analyzed to be 18%. Results show that the fat and protein content of Giloe extract were 0.14gm and 0.64gm/100gm respectively. The ash content in Giloe extract was estimated to be 9.7% which is indicative of high mineral contents. Dietary fibre (crude fibre) has an important role in nutrition; it is found to be 0.16gm/100gm. The energy content was also high being 288.8 cal/100gm. Giloe extract was chemically analyzed for minerals; calcium, phosphorus and iron. Calcium content was found to be 70mg/100gm. Iron content was as high as 9.7mg and this may be a reason why it is used as a tonic in Ayurvedic system of medicine (Singh et al. 2003). A study by Mathew et al (1999) showed that incorporation of Giloe stem extract at 200mg/kg of body weight in mice for five days increased the total white blood cell count significantly.

Nutrient composition of the food products

Based upon the suitability to the purpose of the study, two products Laddu and Mathari were selected, prepared and analyzed for its proximate composition. Both the products were nutrient dense as depicted in Table I. The energy content of the Laddu and Mathari was estimated to be as high as 482.2 cal and 513.2 cal per 100gm of the product prepared respectively. Protein content in both the products was good while fat content was very high particularly in deep fried Mathari (32.2gm). Regarding minerals both the products had good amount of calcium, iron and phosphorus. In Laddu, calcium and iron, in particular, was in very good quantity (40mg and 2.6mg respectively). Nutrient composition of both the products shows that these products can play its part in fulfilling the increased demands of different nutrients of undernourished population with additional benefits of Giloe in improving their capacity to fight with different ill effects of undernutrition.

Table I
Nutritive value of Giloe extract and reference food products (per 100gm)

Products	Energy (cal)	Carbohydrate (gm)	Protein (gm)	Fat (gm)	Fibre (gm)	Moisture (%)	Ash (%)	Minerals		
								Calcium (mg)	Iron (mg)	Phosphorus (mg)
Giloe extract	288.8	71.4	0.64	0.14	0.16	18.0	9.7	70.0	9.7	54
Laddu	482.2	68.9	3.0	21.6	0.47	4.40	1.6	40.0	2.6	86.0
Mathari	513.2	51.3	4.6	32.2	0.17	10.7	1.1	15.1	1.8	67.0

Sensory evaluation of the products

Selection of panel members

Sensory evaluation deals with measuring, analyzing and interpreting the qualities of foods as perceived by the senses of sight, taste, touch and hearing. Most aspects of the quality of foods can be measured by sensory panels. The triangle test is often used for selecting panelists (Jellineck, 1985). Triangle test was carried on 30 members (teachers and students of the food science and nutrition department) and out of these, 15 members were selected as the panels for the present study depending upon their ability and sensitivity to identifying odd samples.

Acceptability of reference/control products

Reference/control products for both Laddu and Mathari were prepared and subjected to sensory evaluation. Sensory scores of these standard products (which served as reference/control) for different attributes are presented in Table II. Results indicated that both the products were highly acceptable for all the sensory characteristics viz. appearance, taste, overall acceptability and after taste. Regarding Laddu, more than 80% of the judges rated it as 'like moderately' to 'like extremely' for all the sensory attributes. Mathari also scored high for all the sensory attributes. This showed that Laddu and Mathari can be a vehicle for the incorporation of Giloe extract.

Table II
Sensory Scores of Reference Products Laddu and Mathari

Products	Mean \pm SD			
	Appearance	Taste	Overall acceptability	After taste
Laddu	7.4 \pm 1.17	8.1 \pm 0.87	8.1 \pm 0.56	8.2 \pm 0.78
Mathari	7.6 \pm 0.69	7.0 \pm 0.81	7.2 \pm 0.91	7.2 \pm 0.91

Acceptability test for bitterness

Giloe has bitter inherent taste thus not widely and frequently used by the all age group people. Incorporation of Giloe extract at various levels (1%, 2%, 3%, and 4%) was tried in both the products Laddu and Mathari. All the four variations of Giloe incorporated products (Laddu and Mathari) were prepared and subjected to multiple comparisons test for bitterness by a panel of trained members. As per the test guidelines, nine point rating scale was developed. The numerical score given was 5 for 'no difference', 1 for 'extreme sweet/extreme salty' and 9 for 'extreme bitter'. In case of Laddu, the responses ranged from 'no difference' (as compared to control/reference) to 'extreme sweet' at one end to 'extreme bitter' on the other. In case of Mathari, the responses ranged from 'no difference' (as compared to control/reference) to 'extreme salty' at one end to 'extreme bitter' on the other. For both the products prepared at different levels of Giloe incorporation, scores were given by 9 panelists on the basis of nine point scale. Total scores on the basis of ratings given by the 9 panelists are depicted in Table III.

Analysis of variance (ANOVA) was conducted to determine the significance of difference between the samples. In case of Laddu, F-value calculated was 1.58, which implies that there

was no significant difference ($p < 0.05$) in bitterness or sweetness among the four levels of incorporations of Giloe extract in Laddu.

For Mathari, the F-value calculated was 7.90 (Table III). This showed there was a significant difference in saltiness or bitterness among the samples. Since, there was significant difference among the samples, the ones that were different was determined by Tukey's test. This test showed that the sample with 4% of Giloe extract was significantly bitter ($p < 0.05$) than the rest of the three samples. No significant difference was found in the bitterness among the samples at 1%, 2%, and 3% level.

Table III
Numerical Scores of the samples at different level of incorporation

Sample	Level of Incorporation				F -value
	1%	2%	3%	4%	
Laddu	43	47	48	49	1.58
Mathari	43	45	46	52	7.90*

*significant $p < 0.05$.

Closeness of the Giloe incorporated products to the reference products

Based on the total scores given by panelists, both the products at different levels of incorporation were classified for their closeness to the reference products. For any of the product, the total score would range from a minimum of 9 to maximum of 81. Accordingly the classification was:

Score Characteristics category

9 -32 More sweeter/saltier than reference

33 – 56 No difference than reference

57 – 81 More bitter than the reference

The distribution of products at different level of incorporation of Giloe as per this classification is given in Table IV. The result showed that all variations of laddu and Mathari fell in the category of no difference than reference.

Table IV
Categorization of the products as per the closeness to the reference product

Category/Scores	Range of Scores of Laddu for all level of incorporation	Range of Scores of Mathari for all level of incorporation
More sweeter/saltier than the reference(9-32)	-	-
No difference than the reference (33-56)	43 to 49	43 to 52
More bitter than the reference(57-81)		

Summary and Conclusion

In this study efforts have been made to evaluate the acceptability potential of Giloe incorporated food products and thus the utilization of its proven ethno medicinal properties in improving nutritional status of vulnerable sections of the society. Result shows that Giloe with its medicinal properties of strengthening immunity, serving as tonic to heart, liver protector, which has also been reestablished by various scientific research, contributes good amount of energy when incorporated in food products. This herb has a high iron content which is indicative of its role in improving blood profiles for iron. Giloe incorporated products at the level of 1%, 2%, and 3% had high acceptability for both types of products sweet (Laddu) and Salty (Mathari). At 4% incorporation level, Mathari exhibited bitterness but Laddu was acceptable. Thus, energy dense products like Laddu and Mathari with Giloe extract incorporation, serve as a value added products and will prove to be beneficial in improving the debilitating condition of undernourished.

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