

Development of iron enriched laddoo by incorporating *Eclipta alba* leaves powder

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■ **ABSTRACT** : Study on the development of iron enriched snack product (laddoos) was conducted with the objective of producing iron enriched product to overcome iron deficiency in different age groups of people. The product was prepared by using dates, sesame seeds and different dry fruits, jaggery and dried *Eclipta alba* leaves powder, which is a highly enriched plant source of iron. Main objective of incorporating *Eclipta alba* leaves in laddoos was to increase its iron content and make it iron enriched to fulfill the iron requirement of all age groups. Results of the study clearly showed that 100 g of product can provide approximately 12 mg iron which can be a good source of iron and can be used as a iron supplement in diet by different age groups of people. The results from the present study revealed that laddoos incorporated with *Eclipta alba* did not affect the taste of the product and found to be highly acceptable, but the colour was darkened compared to control which was due to the colour of the *Eclipta alba* leaves. It was also found from the present study that the overall acceptability of the product prepared by incorporating *Eclipta alba* without adding wheat flour was more, compared to the control group and laddoos prepared by incorporating wheat flour and *Eclipta alba*. Hence, these laddoos can be used as a food supplement to combat Iron Deficiency Anemia (IDA).

■ **KEY WORDS** : Iron, Laddoo, *Eclipta alba*, Leaves powder

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Anemia is a burning problem in India at present. Adolescents, pregnant, lactating mothers, young children and elderly are the most vulnerable population who are suffering from iron deficiency medically known as IDA (NFHS 2005-06).

Estimates suggest that over one third of the world's population is suffering from anemia, mostly iron deficiency anemia. India continues to be one of the countries with very high prevalence. National family health survey reveals the prevalence of anemia to be 70-80 per cent in children, 70 per cent in pregnant women and 24 per cent in adult men. Prevalence of anemia in India is higher because of low dietary intake, poor availability of iron and chronic blood loss due to hook worm infection and malaria (NFHS, 2005-06). The World Health Organization (WHO, 2001) estimates that 43 per cent of all non-pregnant women in 15 to 59 years age group who live in the developing world have anemia; during pregnancy,

this prevalence increases to 56 per cent (Benoist *et al.*, 1993-2005). Anemia has well known adverse effects on physical and cognitive performance of the individual, the true toll of iron deficiency anemia lies in the ill effects on maternal and fetal health. There are many strategies to prevent IDA like pharmaceutical intervention, dietary supplements, and healthy foods. The best strategies among these will be consumption of iron rich supplements in daily life.

The recommended dietary allowance (RDA) of Indian people show that the iron requirement for children is 10 mg/day, adolescent is 15-18mg/day, adult male is 20mg/day, and adult female is 28mg/day, but it increases to 38mg/day in pregnancy and 30mg/day in lactation (Gopalan *et al.*, 2007). So, to fulfill the iron requirement of all the age groups, the iron enriched laddoos which were developed, can be used as a supplement to overcome iron deficiency in pregnant and lactating women as well as all age groups of people suffering

from iron deficiency.

Eclipta alba is considered as a primary liver herb in Ayurveda, where it is called Bhringaraja, Kesharaja or Kesharanjana, and in Arabian medicine, it is known as Kadim-el-bint (Puri, 2003). According to Ayurveda, *Eclipta alba* is alternating, antihelminthic and alexipharmic. It is used for curing hernia, eye diseases, hypertension, fever, leucoderma and anaemia. It is reported as beneficial for complexion, skin and hair due to its property of invigorating peripheral blood circulation of skin (Nadkarni, 1976 and Frawley and Vasant, 1986). *Eclipta alba*, a medicinal plant is rich in ionisable iron and it can be effectively used as a food ingredient to combat IDA.

In the present study, iron enriched snack product (ladoo) was developed to combat iron deficiency of different age groups of people. For developing iron rich ladoos all the iron containing products like jaggery, dates, sesame seed dry fruits, which are good source of iron, *Eclipta alba* was also incorporated in ladoos at 0.6 per cent to increase its iron content as it is very good natural source of iron.

RESEARCH METHODS

The current research was taken up with an objective to develop iron enriched snack product (ladoo) to combat iron deficiency of different age groups of people specially pregnant and lactating women and adolescent girls who are more susceptible to iron deficiency. The materials required to carry out the research were dates (dry), sesame seeds, almonds, cashew nut, raisins, pistachio nut, piyal seeds, peanuts, wheat flour, jaggery, ghee and dry *Eclipta alba* leaf powder.

Three products were prepared out of which one was control (standard recipe); other two were incorporated with *Eclipta alba* out of which one product was prepared by incorporating wheat flour (F1) and the other without incorporating wheat flour (F2). Formulations are given in Table A.

Ingredients	C (control)	F1	F2
Dates	50g	50g	50g
Sesame seeds	20g	20g	20g
Almonds	5g	5g	5g
Cashew nuts	5g	5g	5g
Raisins	5g	5g	5g
Pistachio	5g	5g	5g
Piyal seeds	5g	5g	5g
Peanuts	10g	10g	10g
Jaggery	33g	33g	33g
Wheat flour	10g	10g	-
<i>Eclipta alba</i>	-	1g	1g

C - Control (standard recipe),

F₁ - Standard recipe with *Eclipta alba* and wheat flour and

F₂ - Standard recipe with *Eclipta alba* and without wheat flour

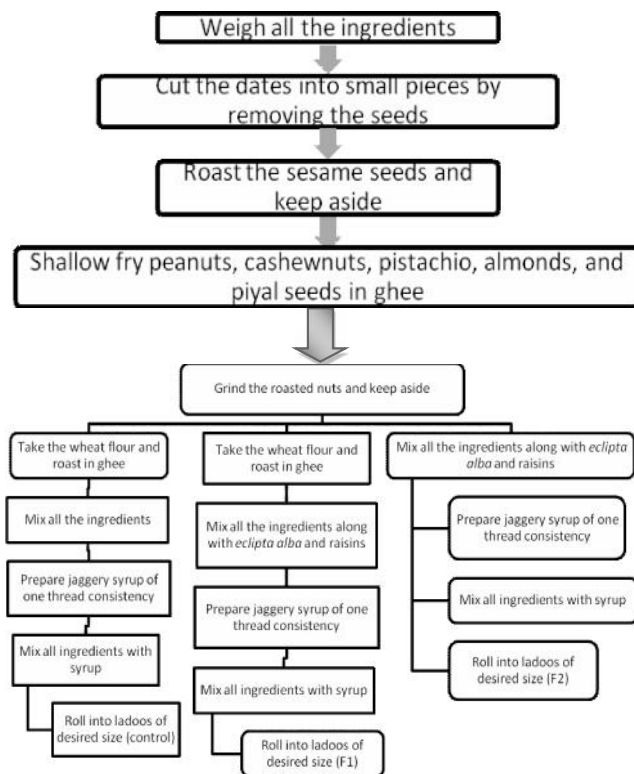


Fig. A: Flow chart

Sensory evaluation :

The sensory evaluation was done to select the most acceptable recipes by using 5 point hedonic rating scale. The panel of judges included faculty from Department of Foods and Nutrition, Post Graduate and Research Centre and a few semi-trained individuals, all of whom were provided with score card to score the test samples for colour, taste, texture, after taste and over all acceptability, compared to the control recipe.

Hedonic scale :

- Like extremely
- Like moderately
- Neither like nor dislike
- Dislike moderately
- Dislike extremely

Nutritional evaluation :

Nutritive value was calculated for major nutrients such as energy, protein, fat and iron in all the three formulations using calculation method from Nutritive value of Indian foods (Gopalan *et al.*, 2007).

Statistical analysis :

The data from the score cards was statistically analysed.

RESEARCH FINDINGS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads:

Colour :

The colour of the control sample was highly accepted by panelists rather than F1 and F2 which may be due to the presence of *Eclipta alba* which imparted dark colour to the products (Table 1).

Flavour :

The flavour of C and F2 was found to be better acceptable than F1.

Taste :

The taste of F2 sample was more acceptable compared to C and F1.

Texture :

The texture of F2 was found to be better compared to C and F1 This could be because of absence of wheat flour in F2 which led to hardness in the ladoos.

After taste :

In all the three samples (C, F1, F2) there was no after

taste observed.

Overall acceptability :

The overall acceptability of F2 sample was ranked high compared to C sample followed by F1 (Table 1).

Nutritional analysis :

The nutritive value of three formulations is recorded in Table 2.

Table 2 shows that the energy, protein and fat contents of three samples were almost same but they were greatly varied in iron content. The iron content of F1 and F2 samples was approximately 2 ½ times higher than control sample.

In 100g of F2 sample, it was found that iron content was increased to 12.3 mg with incorporation of 0.6 per cent *Eclipta alba*. So, present study clearly revealed the fact that ladoos prepared by using all the iron rich product including *Eclipta alba* is good source of iron and can be used as a supplement of iron in diet by anemic people or who are prone to develop anemia. This iron enriched ladoos is not only good source of iron but also provides other nutrients in good amount like protein, energy, fat and other minerals (Table 3).

Conclusion :

The present study revealed that F2 sample was widely

Table 1: Mean value of different parameters of C, F₁, F₂, recipes after sensory evaluation

Parameters	C	F1	F2
Colour/appearance	4.2 ± 0.78	3.9±0.73	3.9±0.73
Flavour	4.0 ± 0.81	3.7±0.48	4.1±0.56
Taste	4.2 ± 0.78	3.8±0.91	4.5±0.52
Texture	3.1 ± 0.73	2.7±0.83	3.6±0.69
After taste	4.1 ± 0.31	3.6±0.84	4.2±0.63
Overall acceptability	3.9 ± 0.87	3.6±0.69	4.2±0.42

C - Control (standard recipe), F₁ - Standard recipe with *Eclipta alba* and wheat flour and F₂ - Standard recipe with *Eclipta alba* and without wheat flour

Table 2 : Nutritive value of the iron rich ladoos

Formulations	Product wt.	Energy (Kcal)	Protein (g)	Fat (g)	Iron (mg)
C	160g	724	13.00	34.00	8.00
F1	160g	728	14.01	34.11	19.07
F2	150g	693.91	12.81	33.94	18.58

C - Control (standard recipe), F₁ - Standard recipe with *Eclipta alba* and wheat flour and F₂ - Standard recipe with *Eclipta alba* and without wheat flour

Table 3 : Nutritive value for 100g of product

Formulations	Energy (Kcal)	Protein (g)	Fat (g)	Iron (mg)
C	451	8.1	21.5	5
F1	455	8.75	21.3	12
F2	462	8.54	22.6	12.3

C - Control (standard recipe), F₁ - Standard recipe with *Eclipta alba* and wheat flour and F₂ - Standard recipe with *Eclipta alba* and without wheat flour

acceptable in terms of all attributes like colour, taste, nutrients specially its iron content compared to C and F1. As the iron content of F2 and F1 samples is around 12g which is approximately half of the RDA requirement, it can be suitable for all age groups. Thus, the product can be utilized widely to help in reducing the prevalence of anemia.

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