

Enrichment of Traditional Spice Mix Powder with Niger Seeds

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Abstract: Iron Deficiency Anemia and Calcium Deficiency in adolescent girls, pregnant and lactating women is the prevailing concern globally, nationally and even at the regional level. The aim of the present study was to nutritionally enrich the traditional spice mix powder with Niger seeds which are an excellent source of Iron and Calcium. Using different amounts of Niger seeds three variations (Basic and 2 Variations) were developed. The Basic standardized recipe consisted of maximum amount (60g) of Niger seeds along with different spices and condiments. Variation 1 was developed in the ratio of 2:1 (2 parts of Niger seeds and one part of Sesame seeds) and Variation 2 was developed in the ratio 2:1 (2 parts of Niger seeds and one part of Bengal gram dal). The sensory attributes i.e. the Color, Flavor, Texture, Taste, After taste and Overall acceptability were evaluated by 70 panelists. The Basic recipe was the most acceptable one with the overall mean score of 8.54 followed by Variation 1(8.41) and Variation 2(8.3). Shelf life study done for 4 weeks revealed that at 5% level of significance there is a significant decrease in the acceptance due to high Fatty acid content of Niger seeds. The serving size was determined to be one tablespoon (15gms). The developed products i.e. Basic, Variation 1 and Variation 2 were able to meet 7.7%, 5% and 7% respectively of the RDA of Iron of an adolescent girl whereas in regards to Calcium it was able to meet 6.8%, 4.8% and 9.4% of the RDA respectively. The enriched Traditional spice mix powder variations i.e. Basic, Variation 1 and Variation 2 were able to meet 5.5%, 3.7% and 5.1% respectively of the RDA of Iron of an pregnant women whereas in regards to Calcium it was able to meet 4.6%, 3.23% and 6.3% of the RDA respectively.

1. Introduction

The World Health Organization (WHO) defines anemia as “a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet the physiological needs” Anemia is one of the most common and widespread nutritional deficiency disorders in the world. (WHO, 2011)

The prevalence of anemia also varies considerably by population characteristics like age, sex, socioeconomic status and biodemographic factors like pregnancy and lactation (Bentley & Griffiths, 2003) women in the reproductive age group are more vulnerable to Iron deficiency resulting in anemia, especially during pregnancy and lactation as they are physiologically and nutritionally at a higher risk (Brooker et al., 2008). Similarly, a lactating mother requires highly nutritious food to accumulate calories for the production of adequate quantity of milk without deteriorating her health (Picciano, 2003) Yet women in developing countries often fail to consume additional food and supplements required to meet the demands during pregnancy and lactation because of fetal growth, alterations in maternal tissues, metabolism, and breast feeding (Kotecha et al., 2009)

In country like India where plenty of natural resources are available and majority of the population is vegetarian, which has low bioavailability, consumption of Iron rich foods significantly help in reduction of Iron deficiency

anemia. Most of the research work on the availability of Iron has been carried out on plant food like cereals, pulses and vegetables. Such studies, however, are limited in the area of nuts and oilseeds even though they are consumed by all the segments of population irrespective of socio economic status. Studies on the availability of Iron from the nuts and oilseeds may make possible the identification of specified nuts and oilseeds rich in available Iron (Allen et al., 2006)

Niger (*Guizotia abyssinica*) belongs to the family Asteraceae, is an erect, stout, branched annual herb, grown for its edible oil and seed. Its cultivation originated in the Ethiopian highlands, and has spread to other parts of the World including India. Niger seed yields about 30-35% of its weight in oil which is polyunsaturated oil with a nutty taste and sweet odor. Its fatty acid composition is similar to sunflower oil and has high content of linoleic acid.

Seed are usually stored for varying lengths of time after harvest. During storage, seed quality is affected by several factors like environmental conditions during seed production, pests, diseases, seed oil content, seed moisture content, mechanical damages of seed during processing, packaging materials, pesticides, air temperature and relative air humidity in storage (TeKrony and Egli,1991);(Reuzeau and Cavalie, 1995) ;(Al-Yahya, 2001); (Guberac et al., 2003)

Table 1: Nutritive value of Niger seeds

Amount (g)	Energy K.cal	Protein (g)	Fat (g)	Carbohydrate (g)	Fiber (g)	Folate (µg)	Iron (mg)	Calcium (mg)
100 g	512	18.02	38.6	22.9	10.9	140	18.1	572

Spice mixes are blended spices or herbs. It is convenient to use these spice mixes in many different recipes or may also be used as an accompaniment to main meals.

They are easy to prepare and are consumed by people of different socio-economic backgrounds mostly by people of low socio- economic background as the spice mix powders are inexpensive, hence fortification of these spice mix powders will benefit the people of low socio

economic background & thereby aid in maintaining their health by meeting their nutritional requirements.

Therefore spice mix powder was the recipe of choice.

2. Materials and Methods

The main ingredients were Niger seeds, Sesame seeds, Roasted Bengal gram dal and other added spices. The method of cooking was dry roasting.

Sample Size and Collection of Data

The sample consisted of 70 semi-trained panelists i.e. students of age group 21-23 years. And the sample size for shelf life studies was 30 semi-trained panelist.

Procurement of Raw Ingredients

The raw ingredients Niger seeds, Sesame seeds, Bengal gram dal and the added spices were purchased from local market near Tolichowki.

Method of Preparation

Three Variations (one basic and two variations) of traditional spice powder mix were developed using the above mentioned primary ingredients with supplementation of Niger seeds at different levels i.e. in the ratio of 2:1 (in variation 1 and variation 2) where two parts are of Niger seeds and one part being Sesame seeds and Bengal gram Dal in variation 1 and variation 2 respectively. The ingredients of spice powder were accurately weighed to yield a uniform mixture for each formulation.

Table 2: The different combinations used in the recipe are listed below

Basic Recipe	Variation 1	Variation 2
Niger seeds : 60g	Niger seeds : 40g	Niger seeds : 40g
Cumin seeds : 10g	Bengal gram dal : 20g	Sesame seeds : 20g
Garlic cloves : 20g	Cumin seeds : 10g	Cumin seeds : 10g
Dry red chillies : 10g	Garlic cloves : 20g	Garlic cloves : 20g
	Dry red chillies : 10g	Dry red chillies : 10g
Total : 100g	Total : 100g	Total : 100g

*A variation with peanut was also planned but was eliminated as it scored minimal in Numerical rating test

Sensory evaluation of the product

Sensory evaluation is a scientific discipline that applies the principles of experimental design and statistical analysis to the use of human senses (sight, smell, taste, Texture) for the purpose of evaluating food products. The discipline requires panels of human assessors, on whom the products are tested and recording the responses made by them. The sensory evaluation was carried out on the basic and variations of the traditional spice powder mix. A group of 70 non-trained panelists i.e. students participated in the sensory analysis which was conducted in a calm place. The time selected for conducting sensory evaluation was 11:00 am when the panel members are neither too hungry nor well fed. Three variations (basic and 2 variations) were placed together in front of each member with a score card (Appendix 2) to rate the traditional spice powder mix. The panelists rated the products, and were asked to assess the spice powder mix for attributes such as

Overall acceptability, Color, Flavor, Texture, taste and after taste.

Sensory evaluation by the panel members

A sensory panel may be described as a group of testers who have exceptional sensory faculties and can describe products on the basis of taste, smell or feel. In sensory testing, consumers are employed to function as instruments to measure product differences, characteristics or preference levels. Sensory skills vary among consumers and sensory performance is affected by numerous factors related or unrelated to the products, consumer qualifications to take part in sensory tests should be carefully diagnosed.

Shelf life studies

Shelf life is the recommended maximum time for which products can be stored maintaining its optimum quality and safety. Shelf life is a guide for the consumer of the period of time that food can be safely kept before it starts to deteriorate, provided optimum storage conditions have been maintained. The shelf life of a product begins from the time the food is prepared or manufactured. Its length is dependent on many factors including the kind of ingredients used, manufacturing process, type of packaging and how the food is stored. It is indicated by labeling the product with a date mark.

The sensory evaluation was carried out on all the 3 recipes; one basic and 2 variations till four weeks from the day of preparation. A group of 30 non-trained panelists i.e. students participated in the sensory analysis. The sensory evaluation was conducted in a calm place. The time selected for conducting sensory evaluation of the samples was 11:00 am when the panel members were neither too hungry nor well fed. Four samples were placed together in front of each member with a score card (appendix 2) to rate the samples on the basis of Color, Texture, Flavor, taste and after taste qualities during the storage duration. The panelists evaluated the products on hedonic scale. A score of 9 indicated "like extremely" and a score of 1 "dislike extremely" while a score of 5 meant "neither like nor dislike".





Plate 1: Sensory evaluation of Basic Recipe and 2 Variations

Estimation of mineral content

Estimation of the mineral content of the product

Approximately 10gms of the sample was weighed in a Petri dish of known weight. The Petri dish containing the sample was placed in hot air oven maintained at 100°C for 3 hours. The Petri dish was removed, covered with the lid, cooled in a desiccator and weighed. The same process is repeated at hourly intervals till successive weights do not differ by 2-3mg or until a constant weight is achieved.

Moisture analysis is followed by the ashing. Ash content is the portion of the food or any organic material that remains after it is burned at very temperatures. After dry ashing is done, incineration at high temperatures (525°C or higher) accomplished in a muffle furnace.

After ashing was done ash solution was prepared and the mineral content was estimated. Estimation of mineral

content such as Calcium (Ca⁺²) was performed using titrimetric method, whereas Iron content was estimated by Colorimetry.



Plate 2: Charring of the developed product
Plate 3: Incineration in Muffle furnace

3. Results and Discussion

Sensory characteristic of Traditional spice powder mix was determined by a group of 70 non-trained panelists i.e. students participated in the sensory analysis. All the panelists were conversant with the factors governing the quality of the products. Each panelist evaluated the following characteristics a) Color, b) Flavor, c) Texture, d) Taste, e) After taste f) Overall acceptability. The variations were rated using the 9 point Hedonic rating scale. The average score of each sample was then calculated.

Table 3: Sensory scores of the developed product

	Color	Flavor	Texture	Taste	After Taste	Overall Acceptability
BASIC	8.28±0.61	8.47±0.75	8.51±0.62	8.48±0.69	8.4±0.81	8.54±0.63
Variation 1	8.37±0.70	8.34±0.71	8.33±0.70	8.28±0.71	8.23±0.80	8.41±0.64
Variation 2	8.21±0.71	8.22±0.70	8.24±0.72	8.3±0.74	8.13±0.82	8.3±0.70

*Data represents means and SD of three determinations

Shelf life study was conducted for four weeks from the day of preparation and week one data means were compared with that of the means of week four data.

Table 4: Mean scores of shelf life studies Week 1 vs. Week 4

	Color		Flavor		Texture		Taste		After taste		Overall acceptability	
	W1	W4	W1	W4	W1	W4	W1	W4	W1	W4	W1	W4
Basic	8.6	8.13	8.6	8	8.7	8.2	8.6	8.2	8.5	8.6	8.6	8.2
Variation 1	8.5	7.9	8.4	7.9	8.4	7.9	8.5	7.9	8.4	7.8	8.4	8.03
Variation 2	8.4	8.06	8.3	7.7	8.5	7.8	8.4	7.8	8.2	7.7	8.3	8

Estimation of Iron content of the developed product

Iron content of the developed product variations i.e. Basic, Variation 1 and Variation 2 were estimated by Wong’s method (appendix 5). And the results are tabulated below.

Table 5: Comparison of Nutritive value and Nutrient analysed in lab

	Nutritive value calculation (Iron)	Nutrient analysed in lab (Iron)
Basic	12.1mg/100gms of product	9.23mg/100ml of ash solution
Variation 1	12mg/100gms of product	8mg/100ml of ash solution
Variation 2	8.5mg/100gms of product	6mg/100ml of ash solution

Estimation of Calcium content of the developed product

Calcium content of the developed product variations i.e. Basic, Variation 1 and Variation 2 were estimated by Titrimetric (appendix 6). And the results are tabulated below.

Table 6: Comparison of Nutritive value and Nutrient analysed in lab

	Nutritive value calculation (Calcium)	Nutrient analysed in lab (Calcium)
Basic	363mg/100gms of product	313mg/100ml of ash solution
Variation 1	505mg/100gms of product	303mg/100ml of ash solution
Variation 2	259mg/100gms of product	243mg/100ml of ash solution

The enriched Traditional spice mix powder variations i.e. Basic, Variation 1 and Variation 2 were able to meet 7.7%, 5% and 7% respectively of the RDA of Iron of an adolescent girl whereas in regards to Calcium RDA for adolescent girl it was 6.8%, 4.8% and 9.4% of Basic, Variation 1 and Variation 2 respectively. The enriched Traditional spice mix powder variations i.e. Basic, Variation 1 and Variation 2 were able to meet 5.5%, 3.7% and 5.1% respectively of the RDA of Iron of an pregnant women (sedentary worker) whereas in regards to Calcium RDA for pregnant women (sedentary worker) it was 4.6%, 3.23% and 6.3% of Basic, Variation 1 and Variation 2 respectively.

Table 7: RDA % that can be met per serving (15g) of spice mix powder

Age group	Iron % of RDA			Calcium % of RDA		
	Basic	Variation 1	Variation 2	Basic	Variation 1	Variation 2
Adolescent girl	7.7	5	7	6.8	4.8	9.4
Pregnant women (sedentary)	5.5	3.7	5.1	4.6	3.23	6.3

Nutritive Value Calculations of Traditional Spice Mix Powder (100gms)**Table 8:** Nutritive value of Basic recipe

S.no	Ingredients	Amount (g)	Energy (K.cal)	Protein (g)	Fat (g)	Carbohydrate (g)	Fiber (g)	Folate (μ g)	Iron (mg)	Calcium (mg)
1.	Niger seeds	60 g	307.2	10.8	23.1	13.7	6.5	84	11	343
2.	Cumin seeds	10g	3.05	1.3	1.6	2.2	3	0.2	0.02	8.7
3.	Garlic cloves	20g	24.2	0.12	0.01	4.3	1.09	15.6	1.8	11.2
4.	Red chillies	10g	2.36	1.2	0.6	0.2	0.2	0.5	0.06	0.9
	Total	100g	337 K.cal	13.4g	25.3g	20.4g	12.6	100.3	12.9	363

Table 9: Nutritive value of Variation 1

S.no	Ingredients (g)	Amount (g)	Energy (K.cal)	Protein (g)	Fat (g)	Carbohydrate (g)	Fiber (g)	Folate (μ g)	Iron (mg)	Calcium (mg)
1.	Niger seeds	40 g	204.8	7.2	15.4	9.2	4.4	56	7.2	229
2.	Sesame seeds	20 g	103.8	4.34	8.61	3.5	3.4	26.2	3	256
3.	Cumin seeds	10 g	3.05	1.3	1.6	2.2	3	0.2	0.02	8.7
4.	Garlic clove	20 g	24.2	0.12	0.01	4.3	1.09	15.6	1.8	11.2
5.	Red chillies	10 g	2.36	1.2	0.6	0.2	0.2	0.5	0.06	0.9
	Total	100 g	339 (K.cal)	14 (g)	26 (g)	19.4 (g)	12 (g)	98.5 (μ g)	12 (mg)	505 (mg)

Table 10: Nutritive value of VARIATION 2

S.no	Ingredients (g)	Amount (g)	Energy (K.cal)	Protein (g)	Fat (g)	Carbohydrate (g)	Fiber (g)	Folate (μ g)	Iron (mg)	Calcium (mg)
1.	Niger seeds	40 g	204.8	7.2	15.4	9.2	4.4	56	7.2	229
2.	Bengal gram dal	20 g	66	4.3	1.06	9.3	3.03	36.4	1.2	9.6
3.	Cumin seeds	10 g	3.05	1.3	1.6	2.2	3	0.2	0.02	8.7
4.	Garlic clove	20 g	24.2	0.12	0.01	4.3	1.09	15.6	1.8	11.2
5.	Red chillies	10 g	2.36	1.2	0.6	0.2	0.2	0.5	0.06	0.9
	Total	100 g	300 (K.cal)	14.2 (g)	18.6 (g)	25 (g)	11.7 (g)	108 (μ g)	8.5 (mg)	259 (mg)

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