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ORGANOLEPTIC EVALUATION OF NUTRITIOUS CHIKKI DEVELOPED BY INCORPORATING NIGER SEEDS (*Guizotia abyssinica cass*)

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ABSTRACT

A lot of product development endeavors have been undertaken to enhance the nutritional status of an existing product and in this study the aim is development of Nutritious chikki. Chikki is a very common edible product prepared in Indian households. It is prepared using number of nutritious ingredients. The following study is aimed to develop chikki using some unconventional ingredients and further making it iron rich by incorporating Niger seeds (*Guizotia abyssinica cass*) at various levels viz., 2.5 grams, 5 grams, 10 grams and 15 grams. Niger seeds are also called as nigella seeds and are an extremely rich source of Iron which is 56.7 g/100 g. The developed product also contains other nutritious ingredients like flax seeds, pumpkin seeds, watermelon seeds, sunflower seeds, chia seeds, sesame seeds, pumpkin seeds and jaggery. The four prepared samples were presented for sensory evaluation and the results were statistically analyzed using mean and standard deviation. Sample A, with 2.5 grams of incorporation was found to be the most acceptable product having an iron content of 6.28mg/100g, which can fulfill around 30% of the daily iron requirement of a normal adult female. Since consumption of Iron rich foods is one of the important strategy to combat Iron deficiency anemia, this study will prove to be beneficial.

KEYWORDS

Anemia, Niger seeds, Chikki, Iron and Hemoglobin.

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INTRODUCTION

Chikki is an edible product which can be prepared by mixing various roasted ground nuts and other ingredients either with sugar and jaggery¹. It provides tonnes of nutrients like proteins, minerals and is a good source of iron and copper². It is very famous across wide section of people in India; various attempts are made to further enrich it with hydrocolloids. Many other ingredients like pieces of dried coconut, sesame seeds, flax seeds and so on can also be used to make Chikki¹. It is one of the

most popular Indian traditional sweet snack which can be found in several different varieties amongst which the most common is peanut Chikki. The preparation of Chikki is very simple in nature. It can be prepared by taking equal proportions of jaggery and any edible raw materials of your choice. Then the jaggery must be crushed with addition of water and should be heated until the temperature reaches 145 degree Celsius. The raw materials should then be added and mix thoroughly till the raw materials get coated with the syrup. It is then spread uniformly by rolling it with the help of a roller, a cutter is used to mark the vertical and horizontal lines to make individual slabs and lastly it is cooled down to room temperature¹.

A lot of product/ingredients have been widely used in the preparation of Chikki like peanuts, sesame seeds etc. Some unconventional ingredients like Niger seeds, Flax seeds, Sesame seeds, Sunflower seeds, Musk Melon seeds, Water Melon seeds, Chia seeds can also be used to make nutritious counterparts of Chikki. An attempt has been made to develop Nutritious Chikki and study the acceptability of the same. The various ingredients of Nutritious Chikki are as follows:

Niger seeds (*Guizotia abyssinica cass*)

Niger seeds mainly cultivated in Ethiopia, and India, is a decotyledonous herb. This crop is moderately to well branched which develops yellow flowers that produce shiny black seeds. The seeds contain 40% oil with fatty acid composition of 75-80% linoleic acid, 7-8% palmitic acid and stearic acid, and 5-8% oleic acid³. The important types of Niger seeds contain 25% oleic and 55% linoleic acid⁴. It is used as a food for human consumption. 'Chibto' and 'lilit' are prepared from these seeds under special conditions which are mixed with roasted cereals, which is preferred for growing youth. Oil extracted from Niger seeds is of high importance in Ethiopia as it is used for birth control and in treatment of syphilis⁵. The sprouted seeds of Niger are mixed with garlic and tej which is used for the treatment of cough. The seeds carry 40% oil and about 20% protein content. The fatty acid content of Niger seeds matches the composition of other composite oil such

as safflower and sunflower. Thus, is considered as one of the healthier selections⁶.

Anemia is the most common nutritional disorder which is a recognized health problem throughout the world. It is most common in young children and women of reproductive age. Iron deficiency leads to iron deficiency anemia. Girls are at higher risk of developing iron deficiency anemia comparison to adolescent boys. During pregnancy, iron deficiency anemia in girls may lead to increased infant and neonatal mortality and low birth weight babies⁷. Some important strategies to improve the iron status of population are by consuming iron rich foods and enhancing the bioavailability of iron from foods⁸. The study conducted by Kumar and Bhatnagar was undertaken between April 2010 and May 2010, in Udaipur, Rajasthan. A group of adolescent girls aged 18-22 was selected and were given Niger seed ladoo supplementation for 4 weeks. The study showed the effectiveness of the daily supplementation of ladoos with improved hemoglobin content among the girls⁹. Several other studies conducted showed that Niger seed supplementation (25g) for 30 days significantly increased the hemoglobin level, was acceptable, and had very few adverse effects¹⁰. It also proved to be a good source of essential metals and free from toxic metal such as Cd and hence safe for human consumption.

Flaxseed (*Linum usitatissimum L.*)

Flaxseed, or linseed, is considered as oilseed crop. It has good amount of α -Linolenic Acid (ALA), omega 3 fatty acid, protein, dietary fiber, lignin. ALA is proved to be really good for infant brain development, reducing blood lipids and cardiovascular diseases. Flaxseed protein are high in arginine, aspartic acid and glutamic acid and flaxseed dietary fiber helps to reduce constipation, keep better bowel movement and as hypocholesterolaemic agent¹¹.

Chia Seeds (*Salvia hispanica L.*)

Chia seeds are a rich source of healthy fats, dietary fiber and various minerals. They are also rich in antioxidants. One tablespoon of chia seeds contains 69 calories¹². Chia seeds are an excellent source of healthy polyunsaturated fats, especially omega-3 fatty acids. One tablespoon of chia seeds provides a

total of 5 grams of fiber which help to lower LDL (bad) cholesterol without lowering HDL (good) cholesterol. It gives 2grams of protein, various minerals especially magnesium and phosphorus¹³.

Sunflower Seeds (*Helianthus annuus L.*)

Sunflower is an important oilseed crop grown in the world. It's a package of healthy unsaturated fats, protein, fiber and other nutrients like zinc, copper, vitamin E, selenium, iron, folate and phytochemicals. Per 100grams the seed contains protein 20.78g, total lipid (fat) 51.46g, ash 3.02g, carbohydrate 20g and fiber 8.6g with total energy of 2445kj¹⁴.

Sesame Seeds (*Sesamum indicum*)

Sesame seeds contain huge amount of nutrients viz., proteins, carbohydrates, antioxidants, lignans, tocopherols and other micronutrients. It is considered to be an extremely beneficial medicine to cure many diseases including properties of anticancer, antioxidative, antiimmunoregulation and antihypersensitivity. It is also proved to be helpful in lowering cholesterol, controlling blood pressure, dermatological and many more areas¹⁵.

Watermelon seeds (*Citrullus lanatus*)

Watermelon is a fruit crop belonging to the family cucurbitaceae. The watermelon seed has moisture content of 7.40-8.50%; fat 26.50-27.83%; protein 16.33-17.75%; fiber 39.09-43.28%; ash 2.00-3.00%; carbohydrate 9.55-15.32% and energy value of 354.05-369.11 kcal/100g. Watermelon seeds are rich source of fiber and minerals which are essential for the body system. It has certain antioxidants which offer protection against damage to tissues and encourage collagen growth. Consumption of these seeds may help reduce the chances of getting cardiovascular diseases and also cancer due to the high amount of total phenols found in the seeds and its antioxidant activity¹⁶.

Muskmelon seeds (*Cucumis melo L.*)

The muskmelon seeds are rich in ascorbic acid, folic acid, carotene, potassium as well as a number of other human health-bioactive compounds and therefore are an extremely healthy food choice¹⁷. Cucurbitacins found in Muskmelon is a natural anti-cancer agent and has also proved to possess significant anti-tumor activity. Some other

traditional uses of muskmelon are that it can help in maintaining, kidney functions, reduces blood pressure and prevent cardiac dysfunction, possess anti-rheumatic and anti-gout properties. Its fruit can also be used as a cooling agent or moisturizer for the skin¹⁸.

Pumpkin seeds (*Cucurbita spp.*)

Pumpkin seeds are rich source of nutrients and have proved to be useful in many medicinal properties. It has a protein content of 28-40%, fat 44-53% and carbohydrate 7-10%¹⁹. They are rich sources of unsaturated oil, energy and vitamin E, and the acids present in it are oleic 29% and linoleic 47%²⁰. It has high amount of macro elements (magnesium, phosphorus and calcium) and moderate amounts of micro elements (calcium, manganese, copper and zinc) and thus the seed could be used as a food supplement²¹.

Jaggery

Jaggery is a traditional Indian sweetener which is nutritious as well as easily available²². The macronutrients which are present in jaggery has many nutritional and medicinal aspects like its anti-carcinogenic and antitoxic activity. It has proved to be better as compared to white sugar. It is known to produce heat and also give instant energy to a human body²³.

MATERIAL AND METHODS

Procurement of raw materials

The Niger seeds, flax seeds, muskmelon seeds, Jaggery and butter were purchased from local mall in Gurgaon. The raw materials were physically examined to ensure that they were disease-free and then stored properly. Watermelon seeds, Sesame Seeds, Pumpkin seeds, and Chia seeds were purchased from a local market called INA market, Delhi.

All the preparation was done in the Nutrition Lab of Amity University, Gurgaon. Niger seeds were added at various levels 2.5g, 5grams, 10grams and 15grams to the chikki. The appropriate amount of all the seeds were weighed using an electronic balance to give the various levels of the seeds mixed and stored in air tight containers for use.

Development of the product (Chikki)

The iron content of Niger seeds is high. Therefore, they were taken as a substrate for product development. The product to be developed is Chikki using Niger seeds, chia seeds, flaxseeds, sesame seeds, watermelon seeds, muskmelon seeds, pumpkin seeds and jaggery (to be added in different variation) are as mentioned in Table No.1.

In this product development, we made four variations in which the content of Niger seeds was altered. The formulation was grouped into A, B, C, and D.

Sensory evaluation of the product

The Sensory Evaluation was being done using 9-point hedonic scale. For each variation, the tests were conducted by 20 different semi trained panel of judges. Each panel member was presented with all the 4 variations and was told to evaluate the samples on the basis of various attributes. The prepared Chikki was evaluated organoleptically on the basis of - Taste, Color, Texture, Firmness, Stickiness, Overall Acceptability. Each individual gave his rating on the basis of his likes and dislikes. After conducting the sensory evaluation, statistical analysis was done. The samples were analyzed statistically using Mean and Standard Deviation, which were calculated on the basis of ratings given by the panel of judges. Picture of all the samples were clicked and the reviews were considered for further possible outcomes.

RESULTS AND DISCUSSION

The main objective behind product development was to develop a product which is nutritionally rich. The product developed in this product is Chikki with the incorporation of Niger seeds at various levels. Since Niger seeds are a good source of iron (56.7 mg/100g), therefore they were chosen to develop the product. The products were statistically analyzed using mean and standard deviation. The mean and standard deviation of product are as shown in Table No.2.

After analyzing the table, we can draw out the results as follows:

SAMPLE A

Taste: The sample has a means score of 8.9 ± 0.94 . This score is the highest of all the samples. In this sample, there was no predominant taste of a particular ingredient, since all the ingredients i.e. Niger seeds, flax seeds, chia seeds, watermelon seeds, musk melon seeds, pumpkin seeds, sesame seeds, etc. were added in equal amounts.

Color

It was dark yellowish in color due to the jaggery. The mean was 8.9 ± 0.80 . The color was quite pleasant.

Texture

In texture, the mean score of Sample A was 8.7 ± 0.94 . It was a desirable texture of a chikki. It was brittle but not very hard to break.

Firmness

This sample was given highest score among all the samples i.e. 9 ± 0.88 and its firmness was similar to that required by the Chikki i.e. neither too hard nor too soft.

Stickiness

The sample was given a score of 9.1 ± 1.04 in stickiness as it had the desired amount of jaggery in it, which provided optimum sweetness and stickiness.

Overall Acceptability

Sample A scored the highest in Overall acceptability, with a mean score of 9 ± 0.85 , it was the most acceptable.

SAMPLE B

Taste

The sample B was having a mean score of 8.6 ± 0.8 in taste. It was slightly different in taste as compared to Sample A.

Color

The sample was given 8.7 ± 0.99 mean score and it possessed a light yellowish color.

Texture

This sample was given a mean core of 8.6 ± 1.01 and the texture of it was slightly grainy because of increased amount of niger seeds.

Firmness

The mean score of sample B was 8.6 ± 0.73 . It was similar to Sample A in firmness.

Stickiness

This sample was given score of 8.4 ± 1.02 and the Chikki was neither too sticky nor too dry.

Overall Acceptability

This sample was also acceptable by the panelists and got an overall score of 8.5 ± 1.28 .

SAMPLE C

Taste

The sample was given a score of 8.2 ± 1.07 and it was quite bitter in taste due to high amount of Niger seeds i.e. 10gms.

Color

Sample C was given 8.4 ± 1.07 score in color and it had blackish color due to the presence of niger seeds along with a yellowish tinge.

Texture

The mean score was 8.5 ± 1.11 in texture. It was grainy, dry and coarse in texture.

Firmness

The sample was given a score of 8.5 ± 1.20 in firmness and it was quite hard to break.

Stickiness

This sample was given a mean score of 8.3 ± 1.34 and it was a bit stickier than the first two samples.

Overall Acceptability

With a mean score of 8 ± 1.41 , this sample scored the lowest in Overall acceptability and was not liked by the panel members.

SAMPLE D

Taste

Sample D was given a mean score of 8.1 ± 1.23 in taste. It was the lowest score. The sample had a bitter aftertaste and was not liked by the panelist as compared to other samples.

Color

This sample was given 8.2 ± 1.20 in color and it was dark black with a bit yellow in color.

Texture: This sample was given least score among all the samples i.e. 7.9 ± 1.16 . Its texture was craggy and dry.

Firmness

This sample had firmness above average so it was too hard to break and it was given least score in terms of firmness i.e. 8.1 ± 1.37 .

Stickiness

This sample was given a mean score of 8 ± 1.48 and the sample was too sticky.

Overall Acceptability

Overall this sample was accepted by some of the panelists and it was given a score of 8.1 ± 1.47 .

It is clearly seen that the sample A containing 2.5gms of Niger seeds is rated best followed by sample containing 5gms, 10gms, and 15gms of Niger seeds. Sample A was also found to be significant on the attribute such as taste, color, texture, firmness, and overall acceptability.

The effect of all these results were calculated on basis of mean and standard deviation. The storage capacity of the Nutri Chikki was also calculated and it was observed that these Chikkis can stay up to 4-5 weeks without addition of any preservative.

The result thus indicates that the panelists accepted the Chikkis prepared from 2.5gms Niger seeds followed by Chikki's prepared from 5, 10 and 15gms.

As per statistical analysis, Sample A was found to be most acceptable. The nutritive value of Sample A was calculated.

Table No.1: Showing Ingredients of Nutri-Chikki

S.No	INGREDIENTS	AMOUNT (In grams)
1	Flaxseeds	10
2	Chia seeds	10
3	Sesame seeds	10
4	Watermelon seeds	10
5	Muskmelon seeds	10
6	Pumpkin seeds	10
7	Niger seeds	---
8	Sample A	2.5
9	Sample B	5
10	Sample C	10
11	Sample D	15
12	Jaggery	3/4 cup (grated or finely chopped)
13	Butter	1 tablespoon

Table No.2: Mean and SD Scores of Sample A, B, C and D

S.No	Attributes	A (2.5gms)	B (5gms)	C (10gms)	D (15gms)
1	Taste	8.9 ± 0.94	8.6 ± 0.8	8.2 ± 1.07	8.1 ± 1.23
2	Color	8.9 ± 0.80	8.7 ± 0.99	8.4 ± 1.07	8.2 ± 1.20
3	Texture	8.7 ± 0.94	8.6 ± 1.01	8.5 ± 1.11	7.9 ± 1.16
4	Firmness	9 ± 0.88	8.6 ± 0.73	8.5 ± 1.20	8.1 ± 1.37
5	Stickiness	9.1 ± 1.04	8.4 ± 1.02	8.3 ± 1.34	8 ± 1.48
6	Overall Acceptability	9 ± 0.85	8.5 ± 1.28	8 ± 1.41	8.1 ± 1.47

Table No.3: NUTRITIVE VALUE OF SAMPLE A (most acceptable product)

S.No	Ingredients	Amount (g)	Energy (Kcal)	Protein (g)	Fat (g)	Carbohydrate (g)	Iron (mg)
1	Flax Seeds	10	53.4	1.8	4.2	2.9	0.57
2	Chia Seeds	10	48.6	1.7	3.1	4.2	0.77
3	Sesame Seeds	10	56.3	1.83	4.33	2.5	0.93
4	Sunflower Seeds	10	62	1.98	5.21	1.79	0.5
5	Watermelon Seeds	10	62.8	3.41	5.26	0.45	0.74
6	Pumpkin Seeds	10	5.84	2.43	4.72	1.56	0.55
7	Muskmelon Seeds	10	3.4	0.08	0.02	0.8	0.02
8	Niger seeds	10	12.8	0.59	0.97	0.42	1.41
9	Jaggery	30	114.9	0.12	0.03	28.5	0.79
10	Butter	10	72.9	Nil	8.1	Nil	Nil
TOTAL			492.94	13.94	35.94	43.12	6.28

CONCLUSION

After the calculation, it was found that the iron content of the Nutri Chikki was 6.28 mg, which fulfils 40% of the iron requirement of a normal adult male and 30% of the iron requirement of a normal adult female (NPNL) as per the recommended dietary allowances. Thus, it can be concluded that niger seeds, which are usually used as a condiment in food, can be added to enhance the iron content of food products up to a level of 2.5 grams. The

calculated Nutritive value of the developed nutritious chikki is shown in Table No.3.

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CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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