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Development and Evaluation of Value Added Nutri Chocolate Incorporated with Garden Cress Seeds

Naziya Fathima^{1*}, Navaneetha R², Usha Devi C³

¹Research Scholar, Department of Food and Nutrition and Research Centre, Smt. V.H.D Central Institute of Home science, Seshadri Road, Bengaluru, India.

²Assistant Professor, Department of Food and Nutrition and Research Centre, Smt. V.H.D Central Institute of Home science, Seshadri Road, Bengaluru, India.

³Associate Professor and Head of Department, Department of Food and Nutrition and Research Centre, Smt. V.H.D Central Institute of Home science, Seshadri Road, Bengaluru, India.

*Corresponding author

Abstract

Sugar candies, chocolates, candied fruits with nuts, ice cream, chewing gum and many more are considered as confectionery, of which Chocolate confectioneries are liked by most people. Due to growing health concerns consumers are looking for healthy options in all the foods they consume. In children and adolescents iron and protein requirements are high and hence value addition using millets and garden cress seeds is one way of meeting this iron and protein requirement. An investigation was undertaken to develop and standardise a value added, dark chocolate based iron rich snack, value added, Nutri chocolate. Sensory evaluation, proximate analysis and shelf life study of Nutri chocolate (value added chocolates) was undertaken. The developed Nutri chocolate were subjected to sensory evaluation by 25 semi trained panellists. Sensory qualities evaluated included appearance, colour, texture, taste, odour and overall acceptability. Sensory evaluation results, indicated that Nutri chocolate with incorporation of 52% dark chocolate, 16% jaggery, 14% garden cress seeds, 7% little millet, 5% almonds, 4% coconut and 2% ghee was highly accepted and best rated. A 9-point hedonic rating scale was used. There was statistically significant ($p > 0.02$) difference with respect to texture and overall acceptability. The best rated Nutri chocolate, contained 23.66% moisture, 6.17g protein, 1.83g fat, 0.63g total fiber, 1.19g ash, 66.52g carbohydrate, 269.97 kcal energy and iron 4.66 per 100g with a shelf life of 10-15 days. Iron and protein rich Nutri chocolates developed, standardised and evaluated in this research study can be consumed by lactating woman, children and all age group people.

Keywords: Value Addition, Dark Chocolate, Jaggery, Garden Cress Seeds, Little Millet, Sensory Evaluation

1. Introduction

Millets are a traditional staple food of the dry land regions of the world. In India, millets are grown on about 17 million ha (a unit of surface area equal to 100 ares) with annual production of 18 million tonnes and contribute 10 percent to the country's food grain basket. Millets are highly nutritious and are known to have high nutrient content which includes protein, essential fatty acids, dietary fibre, B-Vitamins, minerals such as calcium, iron, zinc, potassium and magnesium. Millets help in rendering health benefits like reduction in blood sugar level (diabetes), blood pressure regulation, thyroid, cardiovascular and celiac diseases. However, the direct consumption of millets as food has significantly declined over the past three decades. (Dayakar Rao et al., 2017)¹

The major reasons of decrease in consumption of millets is the lack of awareness of nutritional value, inconveniences in food preparation, lack of processing technologies, and the government welfare schemes which supply cereals free of cost. It is important to explore ways for creating awareness regarding the nutritional merits of millets.

Millets have been used as food since time immemorial and an array of traditional foods are prepared across rural India. However, use of millets is decreasing due to several reasons and there is a need to revive their usage.

Value addition is a good initiative in encouraging the use of millet based products. Government of India is also actively promoting their usage. Value added millet products can be useful for both rural and urban areas. Millets have a huge potential for wider usage among both urban and rural population. The processing and utilization of millets in product development has promising prospects with regard to nutritional quality and health benefits and it can be an alternative to cereals. The main purpose is to meet the demand of health conscious consumers for healthy and nutritious, ready to eat foods, with the incorporation of millet grain and its by-products.

2. Dark Chocolate

Chocolate is well known worldwide and used in various confectionaries. Historically chocolate was also known for its various health benefits. (Dillinger et al. 2000)²

Chocolate is high in calories, fats and flavonoids. Chocolate has a protective role in preventing cardiovascular related disorders, hypertension, reducing blood sugar and many more health benefits. K. Haritha, et al (2014).³

Dark chocolate is generally Semisweet or bittersweet and contains no less than 35% by weight of cocoa liquor. White chocolate contains only cocoa butter (at least 20% by weight) and is usually combined with sweeteners and dairy ingredients. Dark chocolate contains appreciable amount of iron, Polyphenols (up to 50mg per gram) and exhibits antioxidant activity.

Dark Chocolate has been consumed from ancient times by humans at least since as early as 460 AD (Seligson, FH et.al., 1994)⁴

2. Jaggery

Jaggery is a traditional sweetener prepared from sugarcane and has very useful nutritive components which are said to provide various health benefits. Jaggery is healthy when compared to sugar as a sweetener and it can replace sugar in all products. Jaggery is not only a good source of iron but it also contains essential nutrients like magnesium, potassium, selenium, manganese and zinc. Jaggery is not only energy rich but it also aids in proper functioning of nervous system, digestion, regulation of blood pressure and heart function. Sulakshana M. Mane, Shobha Udipi, (2015)⁵

3. Garden Cress Seeds

Garden cress seeds (*Lepidium sativum*) are called Allibija in Kannada, Halim in Hindi, Aliv in Marathi, Alivirai in Tamil, Ahiva in Marathi, Adityala in Telugu, Halim in Punjabi, Ahiva in Marathi, Alivirai in Malayalam, Asadiyo in Gujarati, Soru Manimunni in Assamese (Longvah A, et al., 2017)¹⁷. These nutrient rich wonder seeds are used in traditional recipes for overall health and well being, consumed by pregnant and lactating mothers across many states in India. These seeds are rich in Iron, B vitamins and are also high in protein and phytochemicals.

Garden cress (*Lepidium sativum*) belongs to the family Cruciferae and is mostly grown in India, Europe and US. The edible whole seed is a functional food and is known to have health promoting properties. Gokavi, S. S., et al., (2004)⁶.

Garden cress seed contains 25-39 per cent of protein, 33% percent carbohydrate, 2.4per cent crude fat, 7.6% crude fiber and 6.4% minerals, iron (100%). The major fatty acid present in garden cress seeds are alpha-linolenic acid (34.0%) and also contains monounsaturated fatty acids (37.6%), polyunsaturated fatty acids (46.8%) and antioxidants such as tocopherols and carotenoids (Kaur, et al., 2015)⁷.

Garden Cress Seeds (*Lepidium Sativum*) are very high in iron and folic acid content and traditionally these seeds are used to treat iron deficiency anaemia because 100 g of Garden Cress Seeds provide 100 mg of iron (Sheeba, et al., 2016)⁸

Garden cress oil has Linoleic acid: Linolenic acid (LA: ALA) ratio in the range of 1:4–2:3, which could give it a nutritional advantages over the currently available ALA-rich plant oils (Yenge, et al., 2017)⁹.

4. Little Millet

Little millet is grown in dry lands and is one of the oldest and important crop domesticated in India which is used in various food products. (Saloni et al., 2018)¹⁰

Little millet is rich in fats making it suitable for growing kids. Its complex carbohydrate digests slowly which is beneficial for diabetic patients. The little millet is rich in fiber and contains 8.7 gram protein, 75.7 gram carbohydrate, 5.3 gram fat and 1.7 gram mineral and 9.3

mg iron in per 100 gram grain. Little millet also contains phenols, tannins and phytates along with other nutrients. (Swarna Ronanki et al., 2018).¹¹

5. Almonds

Richardson David P , et al., (2009)¹² have reported the nutritional and health benefits of regular consumption of almonds as a healthy food choice and 100 grams of almonds contains around 575 kcal with about 50 percent fat (fatty acid is predominantly Mono unsaturated fatty acids) and saturated fat accounts for around 3.7 grams per 100 grams (known to be lowest among all the nuts).

6. Dessicated Coconut

Dessicated Coconut is a good source of riboflavin, dietary fibre and minerals(calcium, copper and selenium) Consumption of desiccated Coconut helps provide good brain health, strengthens the connective tissues in our body, lowers bad cholesterol level in blood and thereby helps to improve heart health. K.S. Sebastian (July 2017).¹³

7. Ghee

The medicinal properties of Ghee is well documented in Ayurveda. Ghee is widely used in India, Middle East and Africa. Ghee is a rich source of energy , fat-soluble vitamins and essential fatty acids . Milk contains around 70% of saturated fatty acids out of which about 60% are long-chain fatty acids . (Soniya Vyas et al., 2017)¹⁴

It has been shown that intake of ghee by vegetarians up to 10% of their total calorie consumption has no effect on their serum lipid profile in young and healthy individuals . Shankar ,S R et al., (2017) ¹⁵ and Shankar , S R et al., (2005) ¹⁶.

8. Materials and Methods

Development and standardisation of value added Nutri chocolate which are beneficial for children, lactating mothers and adults. Different variations (V1 and V2) were prepared. After various experimental trials, ideal method of preparation was standardised.

Experimental trials were carried out to develop and standardise the method of preparation of value added Nutri chocolate variation (V1 and V2) as shown below:

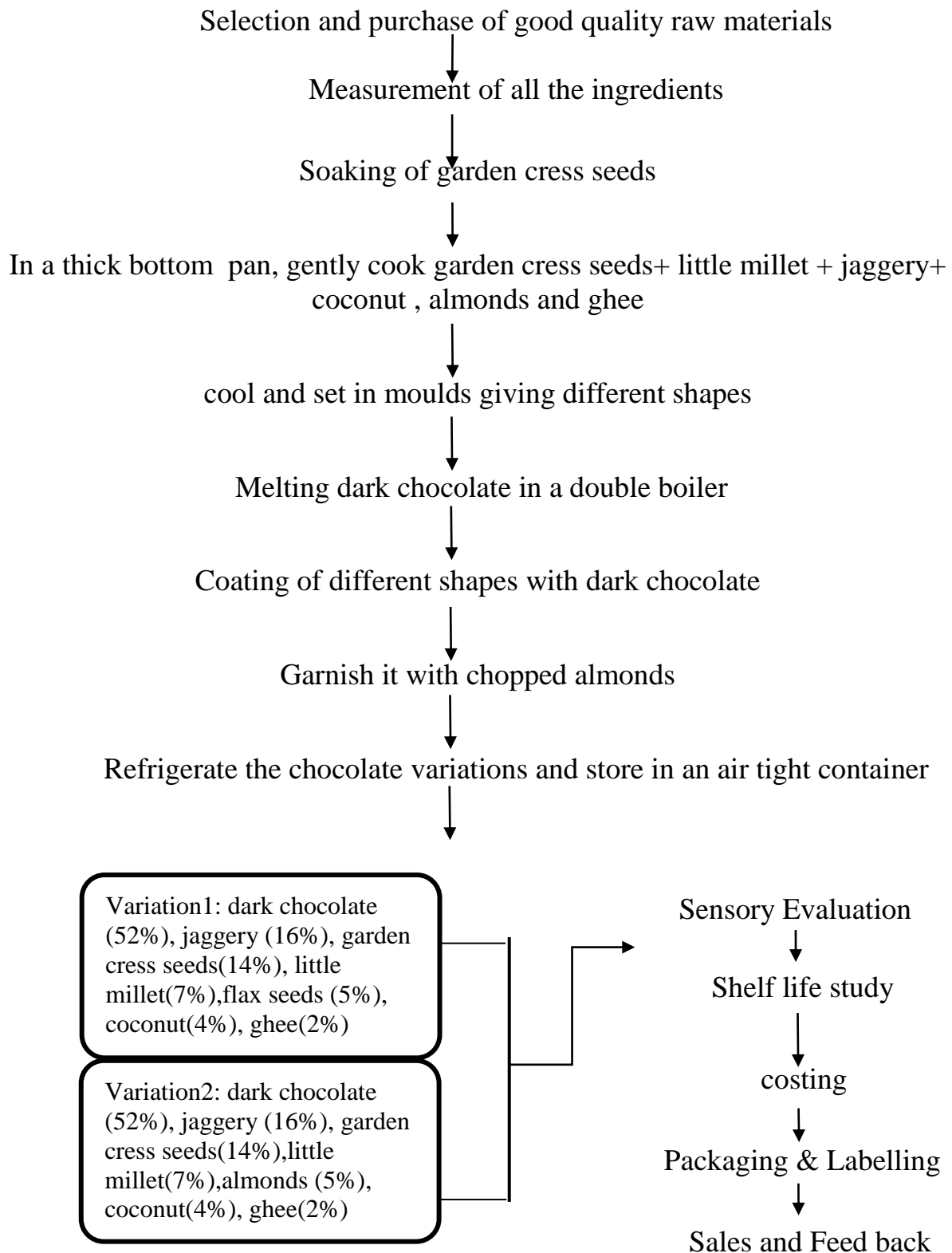


Fig.1. Plan of work for Development of value added Nutri chocolate

9. Method of Preparation of Value Added Nutri Chocolate Variation (V1 and V2)

1. After selection and purchase of Good quality raw ingredients materials (dark chocolate , jaggery , garden cress seeds , little millet , almonds , fax seeds, , coconut , ghee) . The procured ingredients were measured for preparation of Nutri chocolate.
2. Soak garden cress seeds in water in a deep bowl for 3 hours. Do not drain water.
3. Heat ghee in a non stick pan, to this add garden cress seeds
4. To this add little millet, and jaggery and stir constantly for 6-7 minutes
5. Add fine grated dessicated coconut ; chopped almonds/ roasted and coarsely powdered flax seeds to it, and keep it on low flame for a minute
6. Place mixture in moulds and cool for 10 minutes.
7. Melt dark chocolate by using a double boiler
8. Coat the shaped mixture in dark chocolate and garnish with powdered almonds and refrigerate for 5-10 minutes.
9. Wrap chocolates in food graded packaging material

Sensory evaluation was carried out to find the acceptability of iron rich Nutri chocolate using 9 point Hedonic scale by 25 semi trained panelists. Various characteristics like appearance, colour, texture, taste, odour, flavour and overall acceptability were scored using a 9 point hedonic rating scale .

Nutritional composition of standardized iron rich Nutri chocolate was determined by conducting proximate analysis (moisture carbohydrate, ash, fibre, fat, protein and energy) and micronutrient analysis (iron) of final standardized product using different methods¹¹ (IS 78745 , IS 1656 and Physico chemical method)

Shelf life studies were conducted under refrigeration (0-5°C). Food graded plastic containers were used as packaging material.

10. Results

Table.1. Compositions of different variations of Nutri chocolate

Ingredients	Variation 1 Nutri chocolate	Variation 2 Nutri chocolate
Dark chocolate	52%	52%
Jaggery	16%	16%
Garden cress seeds	14%	14%
Little millet	7%	7%
Flax seeds	5%	-
Almonds	-	5%
Dry Coconut	4%	4%
Ghee	2%	2%

Table.2. *Mean Sensory scores of variations (V1 and V2) value added Nutri chocolate

Product	Appearance	Colour	Texture	Taste	Odour	Overall acceptability
Variation-1 (dark chocolate (52%), jaggery (16%), garden cress seeds(14%), little millet(7%), flaxseeds (5%), coconut(4%), ghee(2%)).	8.16± 0.80	8.12± 0.92	7.60± 1.40	8.00±0 .95	7.96± 0.67	8.06± 0.766
Variation-2 (dark chocolate (52%), jaggery (16%), garden cress seeds(14%), little millet(7%), almond (5%), coconut(4%), ghee(2%)).	8.64± 0.56	8.64± 0.48	8.16± 0.55	8.20±0 .64	8.36± 0.56	8.40± 0.33

* 25 semi trained panellists.

Variation 2, has significantly higher mean score the Nutri chocolate, made with dark chocolate (52%), jaggery (16%), garden cress seeds(14%), little millet(7%), almond (5%), coconut(4%), ghee(2%). The product was well accepted by the panel members. The appearance was dark brown. The taste of Nutri chocolate was good. The mean scores of appearance was 8.64 followed by odour with the mean scores of 8.36, taste 8.20 and texture 8.16. From the above table we can conclude that the variation 2 has the highest mean scores for appearance, color, texture, taste, odour and overall acceptability and lowest standard deviation.

At 5% level of significance, there is significance difference between the responses with respect to appearance between variation 1 and variation 2 with p-value=0.018, with variation 2 having highest mean score and less of SD hence variation 2 is considered best when compared to variation 1. The responses with respect to colour between variation 1 and variation 2 with p-value=0.018. with variation 2 having highest mean score and less of SD hence variation 2 is considered best when compared to variation 1. The responses with respect to texture between variation 1 and variation 2 with p-value=0.023, with variation 2 having highest mean score and less of SD hence this variation is consider best when compared to variation 1. The responses with respect to odour between variation 1 and variation 2 with p-value=0.028, with variation 2 having highest mean score and less of SD hence variation is consider best when compared to variation 1.

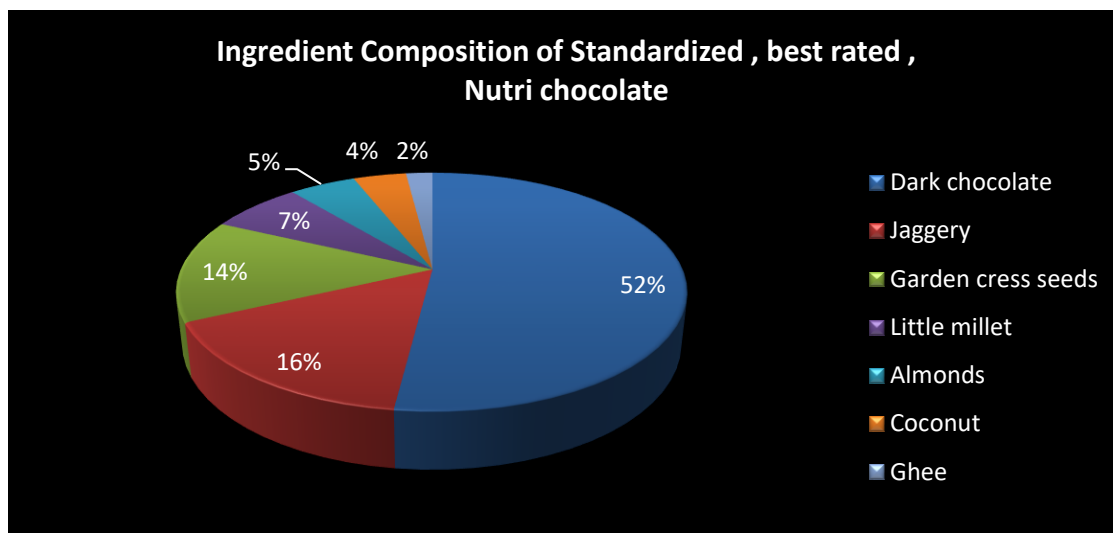


Fig.2. Ingredient Composition of (V2) best rated , Nutri chocolate



Fig.3. Method of preparation of (V2) best rated Nutri chocolate

The standardized - Garden cress seeds based Nutri chocolate is a good source of antioxidants. The innovative Nutri chocolate has all the goodness of chocolate, garden cress seeds, jaggery, Little millet, coconut and almonds.

Table.3. Proximate analysis of best rated (V2) Nutri chocolate

Nutrients	Value per 100g
Energy (kcal)	269.97
Protein (g)	6.17
Fat (g)	1.83
Fibre (g)	0.63
Carbohydrate (g)	66.52
Ash %	1.19
Moisture %	23.66
Iron (mg)	4.66

The standardized , best rated , millet based Nutri chocolate(V2) developed and standardised in this study showed a good amount of iron and protein, which plays an important role in maintaining health.

Table.4. Shelf life of best rated (V2) Nutri chocolate at refrigerated temperature

	Shelf life at refrigerated temperature (3°C)			
Physical examination	5 days	10 days	15 days	20days
Appearance	Dark brown	Dark brown	Dark brown	Dark brown and growth of visible mould
Texture	Soft	Soft	Soft	Soft
Odour	No off odour	No off odour	No off odour	No off odour
Taste	Good	Good	Good	Good
Overall Acceptability	Good	Good	Good	Good

The standardized Nutri chocolate were found to be best and stable at refrigerated temperature (3°C) as the appearance, odor and taste were unchanged until about 15 days (Table IV).

11. Conclusion

Results of this research study showed that the developed and standardised , value added Nutri chocolate produced using the goodness of dark chocolate, jaggery, garden cress seeds, little millet, almonds, coconut and ghee is well accepted . Sensory evaluation results indicate that Nutri chocolate, Variation two (V2) (made using dark chocolate (52%), jaggery (16%), garden cress seeds(14%), little millet(7%), almonds (5%), coconut(4%), ghee(2%)) was best rated by the semi trained sensory panellists. Value addition with novel ingredients increased the energy, iron and protein content of the product and yielded tasty, nutritious Nutri chocolate, having a shelf life of 15 days when kept at refrigerated temperature (3°C). This value added Nutri chocolate can be enjoyed as an healthy snack by consumers of all age groups.

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