

DEVELOPMENT OF PROTEIN RICH NAN-KHATAI

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ABSTRACT

Background: *The health and nutritional status of children is an index of national investment in the development of its future manpower. Malnutrition affects the child's physical and cognitive growth and increases the susceptibility to infections while having an adverse impact on economic growth of the country indirectly. Maternal diet during pregnancy is one of the most important factors associated with infants' birth weight and thus birth weight has often been used as an indicator of woman's nutrition during pregnancy.* **Objective:** *The objective of the study was to develop a Protein-Rich Nan-khatai of which NDP Cal % should be more than 8%.* **Methodology:** *Experimental study was conducted to develop and check Protein Rich Nan-Khatai's nutritive value, sensory attributes and shelf life made from Chickpea Flour, Semolina, Flax Seeds, Watermelon Seeds and Jaggery.* **Results:** *Majority of Trained Panel extremely liked and majority of Semi-Trained Panel liked developed product attributes.* **Conclusion:** *This study highlighted that Protein Rich Nan-khatai will be a promising snack for both children and pregnant lady in terms of protein, fibre and anti-oxidants.*

Key Words: *NDP Cal%, Healthy, Chickpea, Flaxseed, Watermelon Seeds*

INTRODUCTION

The English word protein originated from the Greek word “proteios”, meaning prime or primary. A protein usually contains various amounts of 20 different amino acids (AA) linked via peptide bonds. This term is very appropriate in nutrition, because protein is the most fundamental component of tissues in animals and humans. Dietary protein has no nutritional value unless it is hydrolysed by proteases and peptidases to amino acids, dipeptides, or tripeptides in the lumen of the small intestine. Thus, the content, digestibility coefficients, and relative proportions of AA in dietary protein are the determinants of its nutritional value (Wu, 2016).

Methods for assessing protein quality are either biological or chemical. Net Dietary Protein as Percent of Calories (NDP Cal %), method relates protein quality to energy intake. It is useful in the evaluation of human diets, in which the relation of protein to total calories may vary markedly. It is a proportion of the dietary calories supplied by the protein, corrected for the efficiency of protein utilisation or protein quality, and expressed as percentage. It is useful for the evaluation of human diets to examine or predict if the protein needs of an individual would be met for the total energy consumed in the diet. Diets that provide less than 5 percent of calories in the form of available protein will not meet the protein needs of human adults. For children, pregnant and lactating mothers, an NDP Cal% of at least 8 percent is needed to meet the requirement for growth (Chadha, 2015).

Nutritional status is the condition of health of an individual as influenced by nutrient intake and utilisation in the body (Handa; 2008). According to UNICEF data, 90% of developing world’s undernourished children live in Asia and Africa while 40% of the world’s malnourished lives in India. The 2013 Global Hunger Index Report ranked India 16th, which represents the serious hunger situation.

Nutrition data generated from the fourth National Family Health Survey (NFHS-4) conducted in 2015-16 revealed that the nutritional status of children under five years is critical in the States/UTs of Bihar, Jharkhand, Uttar Pradesh, and Dadra and Nagar Haveli; Kerala and Mizoram are faring better. BMI below normal is most evident in Bihar, Jharkhand, Madhya Pradesh, and Uttar Pradesh; status is better in Sikkim. The incidence of overweight or obesity is highest in Chandigarh, Lakshadweep, Andaman and Nicobar Islands, and Puducherry; the situation is better in Bihar and Meghalaya.

The policy and programme measures initiated in the health sector address various aspects of nutrition and are helping to mitigate the problem. Protein Energy Malnutrition(PEM) control and prevention requires a variety of intervention measures. The government runs the Integrated Child

and Development Services (ICDS) programme under which food supplements are provided up to the age of five, and to pregnant and lactating women (Chadha, 2015).

India is the world's second largest producer of food next to China, and has the potential of being the biggest with its food and agricultural sector. The Indian bakery industry is one of the biggest sections in the country's processed food industry. Bakery products, which include bread and biscuits, form the major baked foods accounting for over 82 per cent of the total bakery products produced in the country. It enjoys a comparative advantage in manufacturing, with an abundant supply of primary ingredients required by the industry, and is the third-largest biscuit manufacturing country (after the United States and China). The bakery segment in India can be classified into the three broad segments of bread, biscuits and cakes (Floris, 2016).

Today, bakery goods are not restricted to bread, cakes and biscuits. Indian market is observing the establishment of bakery café chains in the form of Barista, Café Coffee Day and Monginis. The popular biscuit variants in India are glucose biscuits, Marie, cream biscuits, crackers, digestive biscuits, cookies and milk biscuits. As far as the Indian biscuit market is concerned, the shares of the branded and organised sector and the unbranded and unorganised sectors are 60 per cent and 40 per cent respectively. Indian bakery products, especially biscuits, are in great demand in developing countries (Floris, 2016).

Many bakery products are developed by the incorporation of chickpea flour, semolina, flaxseeds, watermelon seeds and jaggery such as muffins, cookies, sattu, pappads and many other. Globally, chickpea is the third most important pulse crop in production, next to dry beans and field pea. India is the largest chickpea producing country with an average production of 6.38 million MT during 2006-09, accounting for 66% of global chickpea production (Jukantil, 2012). Chickpea is a good source of carbohydrates and proteins, which together constitute about 80% of the total dry seed mass.

Semolina is an organic resource obtained from coarsely ground wheat endosperm. Production of semolina is widely distributed and used around the globe for the preparation of cereals, pasta, spaghetti, etc. Semolina is nutritious with high carbohydrate and protein content. Semolina contains 70.9% carbohydrate, 12.3% protein, 4.4% fat, and 11.6% moisture, with a caloric content of ~372 kcal/100 g. Moreover, semolina has a low glycemic response, which makes it a healthy palatable choice (Chattopadhyay, 2015). Semolina flour has several health benefits, such as; healthy muscles, improves heart health, prevents anaemia, controls over eating, early bowel movement, improves immunity, boost energy, helps in weight loss (Kalra, 2014).

Flaxseed possesses crispy texture and nutty taste. Flaxseed is also known as linseed and these

terms are used interchangeably. Flaxseed is often used to describe flax when consumed by humans while linseed denotes when it is used specifically for industrial applications (Morris,2007). Almost all parts of linseed plant are utilized for various purposes. Seed contains oil which after refining is used for edible purpose. The stem yields fiber of good quality possessing high strength and durability (Kajla, 2015).

It has emerged as an attractive nutritional food because of its exceptionally high content of alpha-linolenic acid (ALA), dietary fiber, high quality protein and phytoestrogens. Flaxseeds contain about 55 % ALA, 28–30% protein and 35% fiber (Rabetafika et al. 2011).Flaxseed as a source of dietary fiber (Mucilage or Gum).

Watermelon (*Citrulluslanatus*) a fruit crop, is a herbaceous creeping plant belonging to the family cucurbitaceae. It is mainly propagated by seeds and thrives best in warm areas (Tabiri, 2016). As per Nutritive Value of ICMR,2010 and from the analysis done by Gopalan et al (2000), it has been revealed that watermelon seeds have high amount of fat (52.6gm/100),considerable amount of protein (34.1gm/100gm), calcium (100mg/100gm),

Hence, the purpose is to utilise the nutrients which give protein, fibre along with energy and good fat. Nan-khatai is a cookie which is soft in texture and melted when keep in mouth. So, it can serve a purpose of a healthy snack. Children can take it with milk and elders can take it with their tea. All the ingredients which are present in nan-khatai are beneficial for health. The strategies for making modified Protein Rich Nan-khatai are Protein rich healthy, medium-Cost cookie. In the present endeavour, purpose is to maintain NDP Cal% more than 8% which is considered to be good for growth and development of children and pregnant lady. Thus, utilisation of chickpea flour will enable to meet the necessary requirement for the growth and development of children and adults. Along with addition of other ingredients which will make it a source of fibre too.With the foregoing in mind, the present study was undertaken with the following objectives:

- To develop protein rich Nan-khatai.
- To calculate nutritive value of developed Nan-khatai.
- To conduct shelf-life analysis of the developed product
- To conduct sensory evaluation of the developed product

METHODOLOGY

Experimental study was conducted to develop protein rich Nan-khatai from Chickpea Flour, Semolina, Flax Seeds, Watermelon Seeds and Jaggery and the acceptability was evaluated.

The product development was done in Home Kitchen, New Delhi. Sensory Evaluation was conducted by Trained Panel and Semi-trained Panel who were selected from Institute of Hotel Management, Catering and Nutrition, PUSA, New Delhi. Sensory evaluation of the product development was done in Food Analysis Laboratory of Institute of Hotel Management, Catering and Nutrition, PUSA, New Delhi. Shelf Life of the product development was done in Microbiology Laboratory of Institute of Hotel Management, Catering and Nutrition, PUSA, New Delhi.

The sample of all the ingredients were procured from the Super Store of Preet Vihar, New Delhi. For sensory evaluation, purposive sampling was done. Thirty panel members were considered for sensory evaluation. Panel members were divided into two groups; first group comprised of Trained Panel (n=5) and second group comprised of Semi-Trained Panel (n=25). The study was conducted for from January, 2018 to April, 2018.

Tools and Techniques: Tools used for product development were measuring cups, measuring spoons, sieve, steel bowl, baking tray & microwave oven. The product was developed in five phases, first the standard recipe was developed for acquiring the skills of making the product. Then, the modification of the ingredients was done on the basis of review and differential trials were conducted.

Nutritive Value of the developed product was calculated from Nutritive Value of Indian Foods (ICMR, 2010). Nutrients were calculated for each trial were- Energy, Protein, Carbohydrates, Fats and Total Dietary Fibre and for evaluation of protein quality NDP Cal% was calculated. For Sensory Evaluation 5 point hedonic scale was used. The Hedonic Rating Scale comprised of Extremely Like-5, Like-4, Neither Like nor Dislike-3, Dislike-2 and Extremely Dislike-1. Sensory Evaluation was conducted in a conducive environment. Before evaluation, the evaluators were asked to rinse their mouth with water. The product was evaluated for various attributes namely Appearance, Aroma, Taste, Texture and Overall Acceptability. Shelf Life Analysis was done by Plate Count method- Spread Plate Count Method Technique. A tenfold serial dilution process was followed in which 1ml of the sample is transferred to a 9 ml of the diluents to get 1:10 dilution.

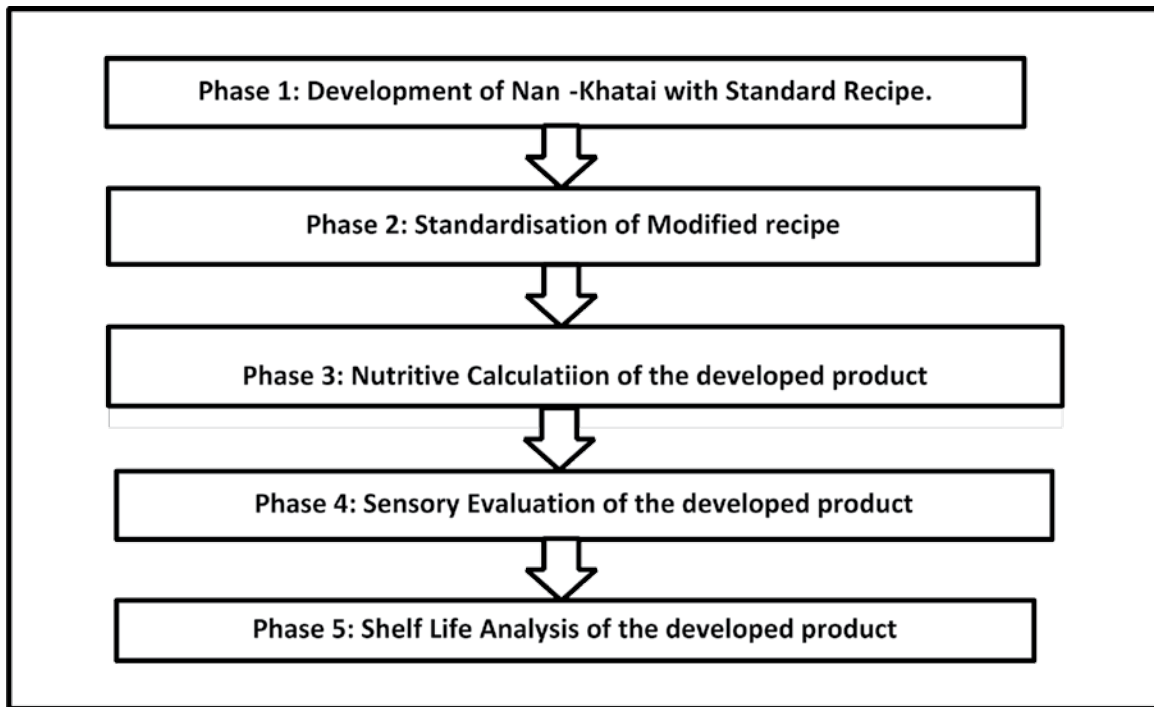


Figure 1: Phases of product development

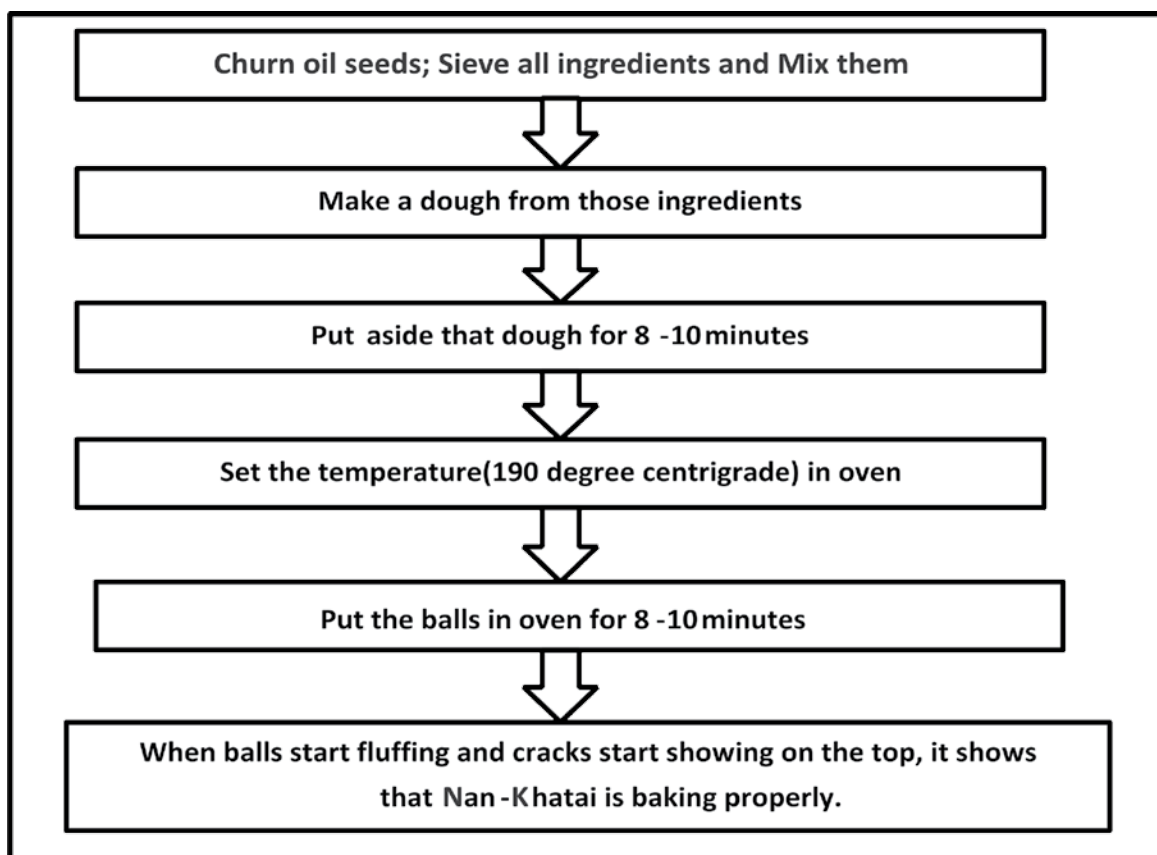


Figure 2: Procedure for developing Nan-Khatai

RESULTS AND DISCUSSION

Product Development: Standard nan-khatai was made with Refined Flour, Semolina, Sugar and Ghee which was found to be nutritionally inadequate. Thus modification was done to develop Protein-Rich Nan-Khatai. The various trials results are in Table 1.

In Trail A, Chickpea flour and semolina were used. Nan-khatai developed was hard, not fluffy and soft. Appearance was dark brown in colour and not attractive and appealing. It was not easily broken as well as very crunchy may be because of excess of oil seeds and semolina. Aroma was not good because of the pungent smell of jaggery. Sweetness was not appropriate and taste was not good. The texture was very melty as same amount of oil seeds and ghee was used. Overall acceptability was not found to be appropriate for the product as it was not good in any attributes (Appearance, Aroma, Taste, Texture and Overall Acceptability). Thus, next trial was conducted.

In Trial-B, developed product was soft and fluffy like a cookie. Light and slight dark brown color indicated that developed product is properly baked. Appearance was attractive and appealing. Aroma of Chickpea Flour & Jaggery both were contributory factor, this happened probably because of use of 50% of jaggery and 50% of sugar. Crunchiness was controlled by reducing the amount of oil seeds. Developed product was delicious as it gave proper sweetness and crunchiness. With the correct addition of Chickpea Flour, Semolina, Refined Flour, Flax seeds, Watermelon seeds and ghee, proper fluffiness, smooth, melty and soft texture was attained.

Table 1: Ingredients amounts of standard, trial and new product

Ingredients (g)	Standard	A	A(%)	B	B(%)
Chickpea Flour	-	30	30	30	30
Refined Flour	40	-	-	5	5
Semolina	10	10	10	10	10
Flax Seeds	-	10	10	5	-
Watermelon Seeds	-	10	10	5	-
Sugar	20	-	-	10	-
Jaggery	-	20	20	10	-
Ghee	20	20	20	5	-

Chickpea has significant amounts of all the essential amino acids except sulphur-containing amino acids, which can be complemented by adding cereals to the daily diet. Starch is the major storage carbohydrate followed by dietary fibre, oligosaccharides and simple sugars such as glucose and sucrose. Although lipids are present in low amounts, chickpea is rich in nutritionally important unsaturated fatty acids such as linoleic and oleic acids. β -Sitosterol, campesterol and stigmasterol are important sterols present in chickpea oil. Ca, Mg, P and, especially, K are also present in chickpea seeds. Chickpea is a good source of important vitamins such as riboflavin, niacin,

thiamine, folate and the vitamin A precursor β -carotene. Chickpea has several potential health benefits, and, in combination with other pulses and cereals, it could have beneficial effects on some of the important human diseases such as CVD, Type 2 diabetes, digestive diseases and some cancers (Yadav, 2016).

An extensive review of literature throws light on the fact watermelon seeds contain a lot of valuable nutrients and may provide considerable nutritional value to the Indian diet. Defatted watermelon seed flour has been used previously to make food products. This research work is an attempt to acquaint the people with these neglected seeds and to determine whether these seeds can find acceptability among the people and therefore can be included in the diet (Biswas, 2017).

Nutritive Value : On calculating Nutritive Value of the standard recipe of Nan-Khatai, the various nutrients for 100 grams was found to be Energy (329 kcals), Protein (6.8g), Carbohydrates (33.8 g), Fats (11.36g) and Fibre (3.8g). NDP Cal% was less than 8%. For the modified product i.e. Protein-Rich Nan-Khatai nutritive value for 100 grams was found to be Energy (365 kcals), Protein (9.4g), Carbohydrates (46.8g), Fats (16.3g) and Fibre (10.37g). NDP Cal% was 8.5% making product optimum for protein availability required for to meet the requirements for growth and development of children and pregnant ladies. (Table 2)

Table 2: Nutritive Value of the developed product

Nutrients	Standard Nan-Khatai (100 gram)	Protein Rich Nan-Khatai(100 gram)	One Piece (33 g)
Energy(kcal)	329	365	121.6
Protein(g)	6.8	9.4	3.1
Carbohydrates(g)	33.8	46.8	15.6
Fats(g)	11.36	16.3	5.4
Fibre(mg)	3.8	10.37	3.4

Children will like Protein-Rich Nan-Khatai as it is a handy healthy snack moreover they can take it either in morning or evening with a glass of milk. Pregnant women can take Protein-Rich Nan-Khatai with their cup of tea either as a morning snack or evening snack. It has good amount of fibre also which prevent the problem of constipation too.

Sensory Evaluation: The results of the Sensory Evaluation conducted by Trained Panel revealed that mean of various attributes were Appearance (4.2+-0.44), Aroma (4.2+-0.83) in Aroma, Taste (5 ± 0), Texture (4.6 ± 0.89), Overall Acceptability (4.6 ± 0.54). The developed product was liked by Trained Panellists. The results of the Sensory Evaluation conducted by Semi-Trained Panel revealed that mean of various attributes was Appearance (3.8 ± 0.6), Aroma (3.76 ± 0.66), Taste (4.36 ± 0.75), Texture (4.24 ± 0.66), Overall Acceptability (4.36 ± 0.56).

Table 3: Sensory attributes by trained panel and semi-trained panel

PROTEIN RICH NAN-KHATAI		
Sensory Attributes	Trained Panel (n=5) Mean ± SD	Semi-Trained Panel (n=25) Mean ± SD
Appearance	4.2 ± 0.44	3.8 ± 0.6
Aroma	4.2 ± 0.83	3.76 ± 0.66
Taste	5 ± 0	4.36 ± 0.75
Texture	4.6 ± 0.89	4.24 ± 0.66
Overall Acceptability	4.6 ± 0.54	4.36 ± 0.56

Shelf Life Analysis: Shelf life analysis which was done for three days on the developed product. It was found that no change was observed for all the three days. the developed product if stored in air tight container in hygienic condition can be kept for more than two days .

Food Label: A food label comprises of name of the product, name and details of the manufacturer, weights and number of contents, ingredients, nutritional information, food allergens and cost of the product.

The developed product label comprises of name of the product, ingredients, nutritive information (energy, protein, carbohydrates and fibre), cost and net weight.

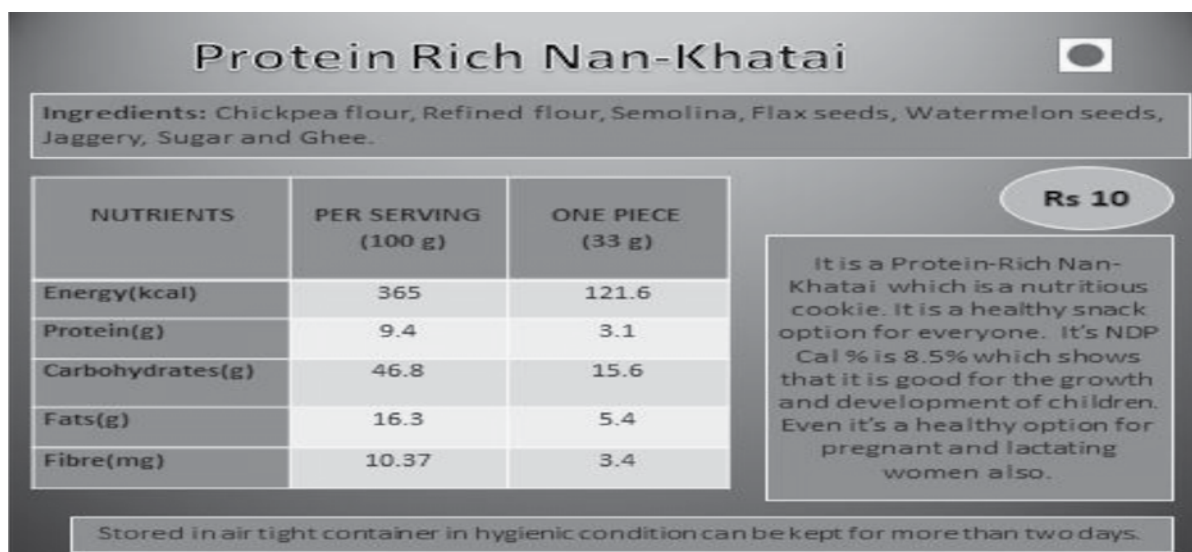


Figure 3: Food Label of the developed product

CONCLUSION

The experimental study was undertaken to develop Protein-Rich Nan-Khatai as a healthy snack for children and pregnant ladies. According to World Health Organization, protein energy malnutrition refers to “imbalance between the supply of protein and energy and the body’s demand for them

to ensure optimal growth and function”. Malnutrition has been defined as a “pathological state resulting from a relative or absolute deficiency or excess of one or more essential nutrients”, it is one of the principle public health problems affecting large sections of populations especially children in developing countries High prevalence of low birth weight, high morbidity and mortality in children and poor maternal nutrition of the mother continue to be major nutritional concerns in India.

The strategies for making modified Protein Rich Nan-khatai are Protein rich healthy, medium-Cost cookie of Rs 10 per 100 g which is a nutritional snack for children and pregnant ladies for their better growth and development. The purpose is to utilise the nutrients which give protein, fibre along with energy and good fat. The best thing in the Protein-Rich Nan-Khatai was any added color, essence and preservative were not used.

All the ingredients are beneficial for health and have their own nutritional health benefits. All the ingredients together make the product acceptable and likeable by the consumers. As a snack, it fulfils the satiety, hunger and nutrient requirements also. This will inculcate a good habit among people for eating healthy nutrient rich cookies.

The ingredients used for product development are healthy and provide appropriate amount of energy, protein, fats and fibres as well as rich in anti-oxidants also. It can be consumed daily as it is better than other processed biscuits or cookies or bakery products which are available in market moreover developed product was not only cross all the test outstandingly even it provides us various nutrients also.

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