

# Development and Quality Evaluation of Commercial Maize Products

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**Abstract**

*The composition of maize endows it with many health benefits. However, maize is naturally deficient in lysine and tryptophan, which are two of eight amino acids regarded as essential for humans and are necessarily to be part of a balanced diet. In light of the above deficiency found in traditional maize the use of Quality Protein Maize (QPM) has brought its usage more productive.*

*QPM differs from common maize in the weight distribution of the five protein fractions. The extent of the change is variable and affected by genotype and cultural conditions. It has been found, however, that the opaque-2 gene reduces the concentration of zein by some 30 percent. As a result, lysine and tryptophan content is higher in QPM varieties than in common maize. QPM based value added products are not available in the market for the consumer, even though products developed from maize have high market potential and are most important food alternative to protein malnourished and gluten sensitive patients. Centre of Excellence on Processing & Value Addition of Maize” initiated in 2014 under nutri farm pilot scheme, Government of India, **has developed more than 20 innovative products** of maize (Bakery products: Nankhatai, Bread, Toast, Cakes, Salted Cookies, Soya Protein Biscuit, Coconut Cookies, Muffins; Extruded Products: Whey and Butter milk based Pastine, Puffcorn; Traditional Products: Fortified popcorn, Khaman, Dhokla, Ladoo, Namkeen, Shakkarpara, Mathri). Most of the products have been analyzed for their nutrient content at Food Laboratory of Junagadh Agriculture University, Junagadh, Gujarat. Further they were subjected to panel of judges & consumers for their organoleptic acceptability and they all were found in the category of “liked moderately” to “liked extremely” category of 9 point hedonic scale. Out of several developed few products like Nankhatai, Pastine Khaman, coconut cookies & cake were introduced to market, small shops, & bakery outlets.*

*It was observed that these products have great market potential and may be introduced as the alternatives/ replacement to the refined wheat flour. Results showed that the protein concentrations improved in the developed QPM based products. Salted biscuits were consumable by all age group as snack with tea or coffee. Pasta is partially cooked extruded product which was strongly liked by children and has high market potential. It can be concluded that incorporation of quality protein maize in place of refined wheat flour improved the quality of the maize products in terms of organoleptic acceptability and nutritional parameters. Hence blend of QPM flour and refined wheat flour has potential as an alternative to replace refined wheat flour intake for better health and innovative commercializable product.*

**Keywords:** Corn, Quality protein maize, Organoleptic profile, Nutrient content

**Introduction**

The composition of maize endows it with many health benefits. Antioxidants present in it neutralize the effects of harmful free radicals that cause diseases like cancer. The high fiber content prevents constipation and colorectal cancer. It also makes it suitable for diets that are made to lose weight and those made with the aim of lowering cholesterol levels. Corn is also a good inhibitor of cholesterol and is a protector of the retina, stimulating blood circulation and also prevents the development of colorectal cancer. It promotes tissue regeneration, prevents cardiovascular diseases,

retards degenerative processes in general, has anti-wrinkle action, increases blood circulation and encourages diuretic action. However, maize is naturally deficient in lysine and tryptophan, which are two of eight amino acids regarded as essential for humans and are necessarily to be part of a balanced diet. In light of the above deficiency found in traditional maize the use of Quality Protein Maize (QPM) has brought its usage more productive.

QPM differs from common maize in the weight distribution of the five protein fractions. The extent of the change is variable and affected by genotype and cultural conditions. It has been found, however, that the opaque-2 gene reduces the concentration of zein by some 30 percent. As a result, lysine and tryptophan content is

higher in QPM varieties than in common maize.

Maize contains 60-68 per cent starch and 7-15 per cent protein. Opaque varieties have more nutrition and contain a high percentage of essential amino acids. Yellow seeded maize is the richest source of vitamin-A. It has more riboflavin as compared to wheat and rice and is a rich source of phosphorus and potash. Maize seed contains 1.2 to 5.7 per cent edible oil. On the other hand maize seeds are deficient in lysine and tryptophan. Due to continuous use of maize in villages of tribal dominated areas, peoples are suffering from “Pellagra disease”. To overcome the condition of malnutrition in tribal areas QPM was introduced in Rajasthan in recent years. But area under QPM is very meager. Further, the value added products of QPM is yet to be tested for its keeping quality and nutritional value. Whereas, the scope of traditional maize value added products will remain in future due to food habit. The attempt has already been made to modify the commonly consumed traditional products of maize like “rabodi” in the form of nutri-rich product ‘pastine’ at College of Dairy and Food Technology, Udaipur for experimental purpose and its acceptability was also tested. The developed product was enriched with protein sources such as whey and butter milk and also other sources of micro-nutrients like fruits and leafy vegetables to combat the problem of nutritional deficiency in maize products.

Looking to the facts, there is a vast scope of preparation of nutri-rich products of maize and entrepreneurship establishment in the Mewar-Vagad region of the south Rajasthan. Such attempts not only will lead to entrepreneurship establishment of value added processed maize products but also provide opportunity of export of maize products and also help to overcome problem of mal-nutrition in tribal dominated areas of southern Rajasthan.

### Objectives

1. To develop & standardize technologies for maize food products and up-scaling
2. Analyze nutritional composition and evaluate safety of selected maize food products.
3. To assess consumer acceptability, price and market strategies for maize processing.

### Methodology

A Performa was developed and standardized to identify various entrepreneurs working for maize based recipes, their quality, quantity and market value. It was found that major maize recipes developed and sold in the market were from small scale entrepreneurs. The recipes included majorly the traditional products like maize papdi, laddu, papad, popcorn, ghat rab, rabodi etc. These are some of the most in demand and consumed by nearly people of all the class.

Centre of Excellence on Processing & Value Addition of Maize, College of Dairy and Food Science Technology, Maharana Pratap University of Agriculture & Technology Udaipur, Rajasthan, India has investigated possibilities of increasing the utilization of maize for food and industrial purposes. Recipe was standardized by using 100% of the QPM flour or incorporated in different ratio with refined wheat flour. The rationale of this study was to investigate sensory characteristics of QPM based baked products in order to judge their consumer acceptability and nutritional value for future industrial and commercial interest.

### Procurement of Raw Material

Quality Protein Maize (*Zea mays* Linnaeus) (Pratap QPM Hybrid-1) have been procured from Agriculture Research Station, Banswara, whereas other raw material required for the preparation of flour blend and *nankhatai* were purchased from local market of Udaipur city in bulk, to avoid any varietal difference.

### Processing of Raw Materials

Quality Protein maize (QPM) variety was identified and availability was checked. QPM Pratap 1 was purchased in a single lot from the University KVK- Banswara for the preparation of various recipes. The maize seeds, which were used in this study passed through winnowing and hand sorting in order to remove stones, dust materials, glumes, stalks, and broken, undersized and immature grains to be used for flour production. QPM seeds were grinded in to flour of size of 50 mesh using hammer mill. This flour was used for further products development. Refined wheat flour and other raw material required for the preparation of products were purchased from the market.

### Standardization of Flour Mix and Product Preparation

A standard recipe is one in which the amount and proportion of the ingredients and method will consistently produce a high quality product. The ingredients are carefully balanced for the number of serving a recipe has to yield. A recipe has two important parts: first list of ingredients and second description of method for putting them together.

For the purpose of standardization of flour mix, a number of preliminary trials were conducted. Different combinations of QPM flour and refined wheat flour viz., 80:20, 70:30, 60:40 and 50:50 percent were used to prepare 100 g QPM based flour blends. These flour blends were then used for the preparation of the products.

### Sensory Evaluation of the Products

The sensory behavior of food products is the ultimate criterion for the acceptability of any product by the consumer. Unless the food products meet the desired standards of taste, flavour and texture etc. the consumer will not accept the products. The sensory qualities such as color, flavor, taste, appearance and overall acceptability were evaluated by panel of thirty judges for assessing the acceptability of the QPM flour blends based baked products (Ranganna, 1986). A panel of thirty judges was identified and one portion of the products each on separate days was served to them for the evaluation of sensory attributes.



Sensory evaluation of *nankhatai* prepared using QPM flour blend

The acceptable level of QPM flour in flour mix was assessed by incorporating 80, 70, 60 and 50 percent of QPM flour in refined wheat flour and standardized for the sensory characteristics. During preliminary trials, it was noticed that incorporation of QPM flour at 80 percent was unacceptable in *nankhatai*. At this level of incorporation of QPM flour, the appearance of the product was affected i.e. darker in colour and taste wise, bitterness was found by the panel where as 50 percent incorporation produced best sensory scores. Hence, in the present study QPM flour was incorporated at 50 percent level in the standardized recipes with refined wheat flour and selected for further nutritional investigations.

### Nutritional Analysis of the Products

The products were then analysed for carbohydrates, protein, fat, ash and fiber using standard procedures at Food Laboratory of Junagadh Agriculture University, Junagadh [1].

### Results and Discussion

The incorporation of quality protein maize in place of refined wheat flour improved the quality of the baked products in terms of organoleptic acceptability and nutritional parameters. Hence blend of QPM flour and refined wheat flour have the potential to replace refined wheat flour intake for better health and innovative commercializable product.

The different recipes included were:

#### 1. Nutri Rich Nankhatai

##### Ingredients: (for 1kg product)

Maize Flour	250 g
Refined wheat flour	250 g
Sugar	300 g
Fat	300 g
Semolina	10 g
Baking Powder	10 g
Milk Powder	10 g
Cardamom	10 g
Pineapple Essence	10 ml.
Pistachio / corn flakes for decoration	



##### Nutritive value

Carbohydrates (%)	True protein (%)	Total Fat (%)	Total Ash (%)	Lysine g/16 g N	Tryptophan g/16g N
54.89	7.01	27.83	0.17	5.4	8.7

#### 2. Maize Bread

##### Ingredients: (for 1 Kg product)

QP Maize Flour	150 g
Refined wheat flour	350 g
Sugar	15 g
Oil	25 ml
Salt	10 g
Yeast	10 g
Water	50- 300 ml



##### Nutritive value

Carbohydrates (%)	True protein (%)	Total Fat (%)	Total Ash (%)	Lysine g/16 g N	Tryptophan g/16g N
61.36	6.37	4.11	1.60	5.5	2.0

#### 3. Coconut Cookies

##### Ingredients (for 1 Kg product)

QP Maize Flour	220 g
Sugar	220 g
Butter	220 g
Grated coconut	220 g
Baking Powder	10 g
Milk/water	100 ml



##### Nutritive value

Carbohydrate (%)	True protein (%)	Total Fat (%)	Total Ash(%)
57.77	5.59	33.14	0.52

#### 4. Salted Biscuits

##### Ingredients (for 1 Kg product):

QP Maize Flour	200 g
Refined wheat flour	500 g
Sugar	180 g
Shortenings	250 g
Salt	12 g
Baking Powder	10 g
Ammonia	10 g
Carom Seeds	10 - 15 g
Milk	200 - 250 ml



##### Nutritive value

Protein (g/100g)	Fat (g/100g)	Fibre (g/100g)	Minerals (mg/100g)	Carbohydrates (g/100g)	Energy (Kcal/100g)
8.53	27.3	0.81	0.94	87	566

#### 5. Muffins

##### Ingredients (for 1 Kg product):

Refined wheat flour	250 g
QP Maize Flour	250 g
Sugar	375 g
Butter	400 g
Eggs	6
Baking powder	20 g
Salt	2 g
Pineapple essence	20 ml



##### Nutritive value

Protein (g/100g)	Fat (g/100g)	Fibre (g/100g)	Minerals (mg/100g)	Carbohydrates (g/100g)	Energy (Kcal/100g)
6.5	34	0.52	0.82	72.3	626

#### 6. SOY-BISCUITS

##### Ingredients (for 1 Kg product):

QP Maize Flour	200 g
Refined wheat flour	200 g
Defatted soy flour	80 g
Sugar	200 g
Shortenings	200 g
Salt	4 g
Baking Powder	10 g
Ammonia	10g
Water / milk	150-200 ml





## Nutritive value

Protein (g/100g)	Fat (g/100g)	Fibre (g/100g)	Minerals (mg/100g)	Carbohydrates (g/100g)	Energy (Kcal/100g)
6.5	34	0.52	0.82	72.3	626

Sensory evaluation of the products was conducted for the last three consecutive trials during standardization. The overall mean scores of trials ranged from 7.9 to 8.1. Further, it can be discerned from the mean value of sensory attributes viz., colour (7.8), appearance (8.1), texture (7.73), Aroma (8.4), taste (8.13) and overall acceptability (8.04) that the products were highly acceptable by the panel members. Horsfall et.al. Suggested that the breads can be prepared from composite flours containing 5, 10, 15, 20 and 30 percent plantain flour in wheat flour [2]. The quality of breads based on sensory attributes is described by appearance, aroma, texture, and flavor and organoleptically acceptable. Alpaslan and Hayta evaluated the sensory quality of bakery products prepared with corn, soybean, and flaxseed flours [3-5].

## Conclusion

Out of several developed few products like *Nankhatai*, coconut cookies & cake were introduced to market, small shops, & bakery outlets. It was observed that these products have great market potential and may be introduced as the alternatives replacement to the refined wheat flour. Results showed that the protein concentrations improved in the developed QPM based products. Salted biscuits were consumable by all age group as snack with tea or coffee.

## Future Prospects

Quality Protein Maize (QPM) is grown over 9.0 million hectare in the world where as the area under QPM in India is negligible. The dissemination of QPM among the tribal communities and underprivileged parts of India should be taken on a priority.

There is further scope to increase the lysine and tryptophan of maize, lysine being more than 5.0 per cent. In order to achieve this target, there is a need to several million people, particularly in the developing countries, derive their protein and calorie requirements from maize. Animal protein, of course being of higher quality is scarce and expensive, thereby unavailable to a vast sector of the population. Therefore, this vast segment (human population) depends upon cereals for their nutrition and livelihood. Protein from cereals including normal maize, have poor nutritional value because of reduced content of essential amino-acids such as lysine and tryptophan leading to harmful consequences. As a consequence, the use of maize as food is decreasing day by day among health conscious people. Quality Protein Maize grains due to higher productivity, higher content of protein as well as its higher biological value can be better option as food over other cereals like rice and wheat.

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