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Nutritional Importance and Value Addition in Maize

A. Saritha*, A. V. Ramanjaneyulu, N. Sainath and E. Umarani

Agricultural Research Station (Professor Jayashankar Telangana State Agricultural University), Tornala, Siddipet, Telangana (502 114), India

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Corresponding Author

A. Saritha

e-mail: anishetti.saritha@gmail.com

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Abstract

Maize is an important cereal crop of the world and is known as 'Queen of Cereals' due to its multifarious uses and high productivity potential. It plays a very important role in human and animal nutrition in general and meeting the protein and calorie requirement of millions of people across developing countries, in particular. It is also a source of high fiber, antioxidants, other vitamins and minerals. But, in India, a major portion of maize goes for poultry and animal feed. This article narrates scope and opportunities for innumerable number of value added products from Maize which are important for nutritional and livelihood security.

Introduction

Maize (*Zea mays* L.) or corn is a cereal grain belonging to the family Gramineae/ Poaceae, known as 'Queen of Cereals' because of its several uses and higher yield potential among the cereals and wide array of applications in variety of products (Figure 1). In world, it was cultivated in an area of 192.01 million ha with a production of 1123.6 million metric tonnes and productivity 5.85 metric tonnes/ha where as in India, it was cultivated in an area of 27.72 million ha with a production of 3.07 million metric tonnes and productivity 5.85 metric tonnes/ha (United States Department of Agriculture, 2020). Every part of the maize plant has economic value, the grains, leaves, stalk, tassel and cob; all can be used to produce a variety of by-products. Maize is known to play an important role in human and animal nutrition. Maize grains are suitable for hydroponic fodder production especially in hot climatic conditions (Raghavendran *et al.*, 2020). Demand for maize and its secondary level products has been increasing. However, availability of comprehensive information on nutritional importance and value addition in maize is meager, and hence, in this article, we made an attempt to give a brief account of the same.

Importance of Maize

Maize in Food Products

With high content of carbohydrates, fats, proteins and some of important vitamins and minerals, maize acquired a well-deserved reputation as a poor man's nutria-cereal. Maize is used as food product in various ways *viz.,* cooking oil, roasted kernels, puffs, pops, flakes, starch, syrup, biscuits etc.

Maize in Non-Food Products

Maize is also used in non-food products which include toothpaste, detergent, paper, dyes etc. Maize also finds application in food containers, plastic

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E-mail: *bioticapublications@gmail.com*

food packaging, baby powder, diapers, medicine, vitamin tablets, textile products, candies etc. Of late, maize has been processed to produce bioethanol in a big way for blending with auto fuels at international level.

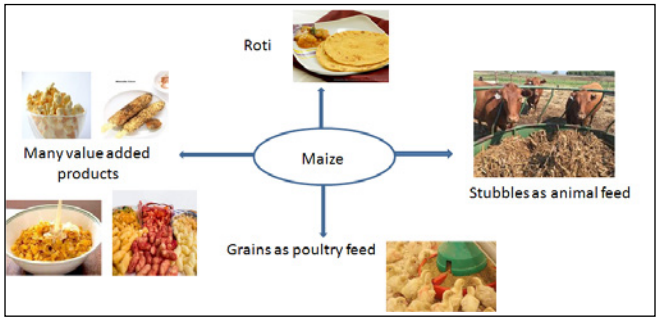

Figure 1: Multiple uses of maize

Nutritional Value of Maize

Maize grains are consumed in raw and cooked forms. It is a good source of carbohydrates and vitamin B-complex. It contains vitamins C, A, and K together with a large amount of beta-carotene and fair amount of selenium that help to improve thyroid gland. The composition of maize kernel is presented in Table 1 (Shah *et al.,* 2015). It also contains vitamin C, vitamin E, vitamin K, vitamin B_1 (thiamine), vitamin B_2 (niacin), vitamin B_3 (riboflavin), vitamin B_5 (pantothenic acid), vitamin B_6 (pyridoxine), folic acid, selenium, N-p-coumaryl tryptamine, and N-ferrulyl tryptamine. Potassium is a major nutrient present which has a good significance because an average human diet is deficient in it (Kumar and Jhariya, 2013). Roasted maize kernels are also used as coffee substitute. Maize germ contains about 45–50 % of oil that is used in cooking, salads and is obtained from wet milling process.

The refined maize oil contains linoleic acid 54–60 %, oleic acid 25–31 %, palmitic acid 11–13 %, stearic acid 2–3 % and linolenic acid 1%. The two main forms of vitamin E present in our diet are alpha (α) and gamma (γ) tocopherols. Maize oil is amongst the rich sources of these tocopherols, especially γ-tocopherol and their reported concentration was 21.3 and 94.1 mg/100 g, respectively.

Health Benefits of Maize

Maize has numerous health benefits. The B-complex vitamins in maize are good for skin, hair, heart, brain and proper digestion. The presence of vitamins A, C, and K together with beta-carotene and selenium helps to improve the functioning of thyroid gland and immune system. Potassium is a major nutrient present in maize which has diuretic properties. The presence of essential fatty acids, especially linoleic acid in maize oil plays an important role in the diet by maintaining blood pressure, regulating blood cholesterol level, and preventing cardiovascular maladies. Maize is believed to have potential anti-HIV activity due to the presence of Galanthus nivalis agglutinin (GNA) lectin also referred as GNA-maize.

Table 1: Composition per 100 g of edible portion of maize

S. No.	Maize kernel characteristics	Quantity
1	Carbohydrate	71.88 g
2	Protein	8.84 g
3	Fat	4.57 g
4	Fiber	2.15 g
5	Ash	2.33 g
6	Moisture	10.23 g
7	Phosphorus	348 mg
8	Sodium	15.9 mg
9	Sulfur	114 mg
10	Riboflavin	0.10 mg
11	Amino acids	1.78 mg
12	Minerals	1.5 g
13	Calcium	10 mg
14	Iron	2.3 mg
15	Potassium	286 mg
16	Thiamine	0.42 mg
17	Vitamin C	0.12 mg
18	Magnesium	139 mg
19	Copper	0.14 mg

Resistant starch (RS) from maize, also called as high-amylose maize, it has various health beneficial effects. It escapes digestion and its consumption helps in altering microbial populations, lowering cholesterol. Maize is an essential source of various phytochemicals that play an important role in our health. Maize grains, especially yellow variety contains large quantities of the carotenoid pigments and has a vital significance in the diet as human beings are not able to biosynthesize carotenoids. These pigments are also beneficial in preventing cancer.

Reasons for Enormous Increase in Maize Consumption

Maize consumption has increased among both rural and urban consumers, but, it has been observed that the demand is shifting to high quality products and processed products in urban areas. Increasing population, urbanization, improvement in standard of living, changing food habits and faster economic growth can be attributed for increasing demand for maize. However, losses in production of

cereals generally and maize specifically, result into decrease in productivity, reduction in farmers' income, food insecurity or hunger, poverty and consequently, reduction in the economic condition of the nation.

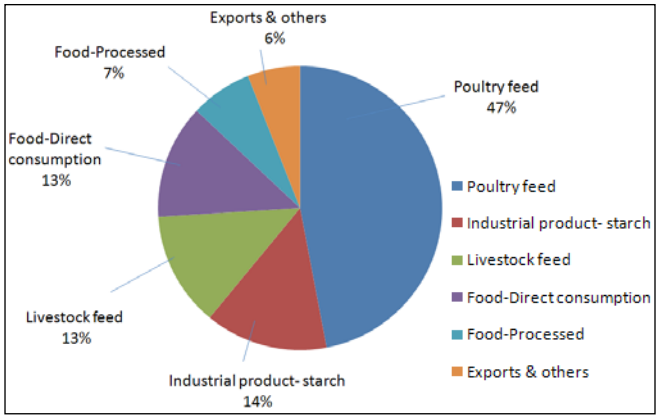

Figure 2: Sector wise maize consumption in India

In spite of wide range of health benefits offered by maize as a source of high fiber, antioxidants and other vitamins and minerals, major portion of maize is still not being used for human consumption and 47% and 13% goes for poultry and animal feed respectively (Figure 2). Historically, demand for the grain was driven by the starch and poultry industries. The demand for starch is strong and is growing 10 to 12 percent every year due to rising consumption in the food and pharma industry. Maize starch, an excellent source of carbohydrates, is a highly versatile industrial raw material and finds extensive applications in the textile, food, pharmaceutical and paper industries. Maize is preferred in poultry feed because of its easy availability. In poultry feed industry, maize constitutes about 60 percent of the feed and therefore is a critical raw material. But with changing food habits, the demand for food additives derived from maize is also growing.

Value Added Products of Maize

Corn Oil

Its main use is in cooking, where its high smoke point makes refined corn oil to a valuable frying oil. It is also a feedstock used for biodiesel. Other industrial uses for corn oil include soap, paint, rust proofing for metal surfaces, inks, textiles, nitroglycerin and insecticides.

Corn Syrup

Corn syrup is a food syrup which is made from the starch of corn and composed mainly of glucose. Corn syrup is used in foods to soften texture, add volume, prevent crystallization of sugar, and enhance flavour (Figure 3).

Corn Flakes

Corn flakes being one of most nutritious foods and is consumed as breakfast food not only in India but elsewhere in the world. Besides the good taste, crispy

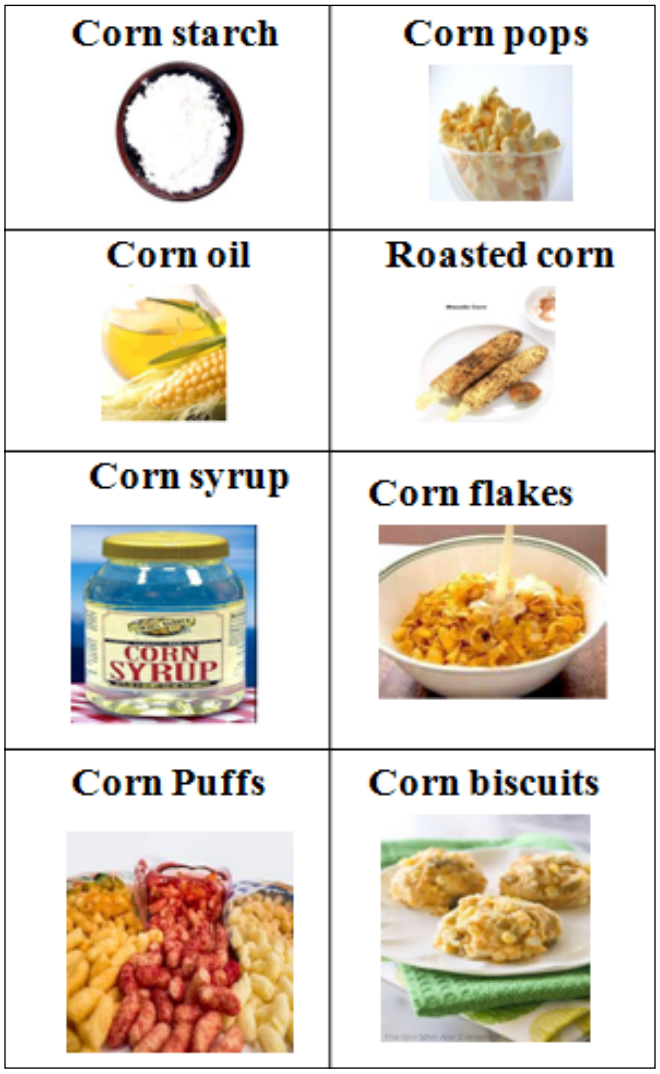

Figure 3: Value Added Products of Maize

nature corn flakes are also popular because of their friable texture blend flavour and above all the ease with which it can be prepared for consumption. There is a good scope to develop this important agro-based food processing industry especially in the maize growing states to cater to the increasing demand of the metropolitan and industrialized cities.

Corn Pops

Popcorn is a popular snack food at sporting events and in movie theatres. Traditions differ as to whether popcorn is consumed as a hearty snack food with salt (predominating in the United States) or as a sweet snack food with caramelized sugar (predominating in Germany). Popcorn is naturally high in dietary fiber and antioxidants low in calories, fat, free of sugar and sodium. This can make it an attractive snack to people with dietary restrictions on the intake of calories, fat or sodium. For the sake of flavor, however, large amounts of fat, sugar, and sodium are often added to prepared popcorn, which can quickly convert it to a very poor choice for those on restricted diets.

Roasted Corn

Masala Butta or Spiced fire roasted corn on the cob is a favourite street snack in India when corn is in season. Street vendors roast the corn on coal fire or open grill, use a lime to rub in the Indian spices and serve it hot. People can be seen walking around with the corn in hand.

Conclusion

Maize is blessed with wide ranging nutritional values and offers good scope for production of wide variety of value added products. Commercialization, promotion and adoption of maize based value added food products will not only ensure higher returns to farmers but also generate employment for women and youth with improved dietary diversity in food choices to the consumers. Further, it assures food and nutritional security.

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