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Impacts of Maize Consumption for Overall Growth of Human Being

Lokesh Kumar Jain, M. P. Verma, S. C. Meena

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ABSTRACT

Maize (*Zea mays* L.) is popularly known as corn and is belongs to Gramineae or grass family, originated from Central America. It was introduced into north-west Himalayas of India, probably in early 17th century through silk route. It is a third leading crop of the world after rice and wheat (Sandhu, Singh *et al.* 2007). The world production of maize was 1100 million metric tons (MMT) and in India its production was 28.7 million tonnes in 2016–17 (Agricultural Statistics at a Glance 2018). In India, Karnataka is leading producing state followed by Maharastra and Madhya Pradesh. It is also known as "queen of cereals" because of very high yield potential. Over 85% of maize produced in the country is consumed as human food. *Zea mays* is the most important cereal fodder and grain crop under both irrigated and rainfed agricultural systems in the semi-arid and arid tropics maize kernel is an edible and nutritive part of the plant. More than 3,500 uses of corn products are nominated. Green cobs are roasted and consumed by people with great interest. The grains of special variety called the 'pop corn', are characterized by a hard corneous interior structure are converted into the 'popped' form, which is the favourite food for children in urban areas. Several food dishes including chapaties are prepared out of maize flours and grains. It is also a good food for poultry, piggery and other animals. Soft drinks like Pepsi and Coca-Cola contain corn sweeteners. Corn flakes are a popular breakfast now a days in many countries. Maize is gluten free grain over look the side effects of gluten for the people who are suffering from celiac disease or gluten disorders. Maize is typically yellow but comes in a variety of other colors such as white and red. Whole-grain corn is as healthy as any cereal grain, as it's rich in nutrients, fiber, contains complex carbohydrates and many vitamins, minerals, and antioxidants. It is a source of nutrition as well as phytochemical compounds. It contains various major phytochemicals such as carotenoids, phenolic compounds, and phytosterols,

Keywords Maize, Classification, Importance, Health hazards.

Lokesh Kumar Jain*
Assistant Professor (Agronomy)

Dr M. P. Verma
Assistant Professor (Animal Production)

Dr S. C.Meena
Assistant Professor (Plant Pathology)
Assistant Professor, Agronomy

College of Agriculture, Sumerpur 306902 (Pali Rajasthan)
Email : jainlokesh74@gmail.com
*Corresponding author

Classification

Maize is an annual C_4 plant classified into 7 groups by Sturtevant (1899) based on the endosperm of kernels. (C4 plants, which use an alternative pathway for photosynthesis in which the first product is a four-carbon

compound and show alterations in their anatomy and ultrastructure in order to avoid photorespiration.)

Dent corn (*Zea mays indentata* Sturt): It is popularly known as dent corn because of dent formation on the top of the kernel having yellow or white color. The depression or dent in the crown of the seed is the result of rapid drying and shrinkage of the soft starch. It is higher concentration of soft starch. This is the most common type of maize grown in the USA.

Flint corn (*Zea mays indurata* Sturt): The endosperm in this type of maize kernel is soft and starchy in the center and completely enclosed by a very hard outer layer. The kernels are round on the top. It is higher concentration of soft starch. It was discovered by Europeans with early maturity and can germinate in cold and wet soil. It is principal type of grain corn grown in India.

Pop corn (*Zea mays averta* Sturt): The size of kernel is small and the endosperm is hard. When they are heated (at 170°C), the pressure built up within the kernel suddenly results in an explosion and the grain is turned inside out. The grain is used for human consumption and is the basis of pop-corn confections. Its cultivation is mainly confined to the New World.

Flour or Soft corn (*Zea mays amylacea* Sturt) : It possesses a soft endosperm. Kernels are soft and of various colors, but white and blue are most common. It is widely grown in the USA and South Africa. In South American its use is in preparation of beer.

Sweet corn (*Zea mays saccharata* Sturt): The sugar (20% on dry basis at green ear stage) and starch make the major component of the endosperm, which results in sweetish taste of the kernels before they attain the maturity. Its sweetness is because of recessive mutation in metabolism which prevents its transformation sugar to starch. After maturity, the kernels become wrinkled. It is grown in green ears and harvest at approximately 18 to 20 days post pollination. The cobs are picked up green (with 70% moisture) for canning and table purposes. Yellow is predominant grain color and are rich in Vitamin A and C

Pod corn (*Zea mays tunicata* Sturt): Each kernel is enclosed in pod or husk in an ear which is enclosed in husks like other types of corn. It is a primitive type of corn not grown commercially. It is mostly grown for research purpose to trace the genetic root of corn.

Waxy corn (*Zea mays ceretina* Kulesh): Kernels have waxy appearance. Starch is entirely composed of amylopectin in contrast to common dent corn starch with 78% amylopectin and 22% amylose. The waxy corn supply raw materials for speciality products of the wet milling starch industry for textile and paper sizing.

Table : Nutrient content in maize grain.

Nutrition	Unit	100g
Corn grain, yellow		
Water	g	10.37
Energy	kcal	365
Protein	g	9.42
Total lipid (fat)	g	4.74
Carbohydrate, by the difference	g	74.26
Fiber, total dietary	g	7.3
Sugars, total	g	0.64
Minerals		
Calcium, Ca	mg	7
Iron, Fe	mg	2.71
Magnesium, Mg	mg	127
Phosphorus, P	mg	210
Potassium, K	mg	287
Sodium, Na	mg	35
Zinc, Zn	mg	2.21
Vitamins		
Vitamin C, total ascorbic acid	mg	0.0
Thiamin	mg	0.385
Riboflavin	mg	0.201
Niacin	mg	3.627
Vitamin B-6	mg	0.622
Folate, DFE	µg	19
Vitamin B-12	µg	0.00
Vitamin A, RAE	µg	11
Vitamin A, IU	IU	214
Vitamin E (alpha-tocopherol)	mg	0.49
Vitamin D (D2 + D3)	µg	0.0
Vitamin D	IU	0
Vitamin K (phylloquinone)	µg	0.3
Lipids		
Fatty acids, total saturated	g	0.667
Fatty acids, total monounsaturated	g	1.251
Fatty acids, total polyunsaturated	g	2.163

(Values are based on a 2,000 calorie diet)

Source – USDA (https://fdc.nal.usda.gov/fdc-app.html#/food-details/170288/nutrients)

Carbohydrates

Starch is its main carb, comprising 28–80% of its dry weight. Corn also provides small amounts of sugar (1–3%) particularly sucrose but sweet corn is a special, low-starch variety having higher sugar content (18% of the dry weight). Resistant starch (RS) from maize reduces the risk of cercal cancer, atherosclerosis and obesity related complications.

Fiber

The predominant fibers in corn are insoluble ones, such as hemicellulose, cellulose and lignin. Popcorn and other high-fiber foods were once believed to trigger the diverticular disease (diverticulosis) characterized by pouches in the walls of your colon. The main symptoms are cramps, flatulence, bloating and less often bleeding and infection.

Protein

Corn contains 10–15% protein depending on the variety buts its quality is poor. The most abundant proteins in corn are known as zein, accounting for 44–79% of the total protein content. Zein an alcohol-soluble prolamine found in maize endosperm has unique novel applications in pharmaceutical and nutraceutical areas (Rouf Shah *et al*. 2016). Further, they are used in the production of adhesives, inks and coatings for pills, candy and nuts. Everyone needs at least 0.8g of protein per kilogram of body weight.

Corn oil

The fat (corn oil) content of corn ranges from 5–6% and is used for cooking. This oils is mainly composed of linoleic acid, a polyunsaturated fatty acid, while monounsaturated and saturated fats make up the rest. It also contains significant amounts of vitamin E, ubiquinone (Q10) and phytosterols, increasing its shelf life and making it potentially effective at lowering cholesterol levels.

Vitamins and minerals

Corn may contain a fair amount of several vitamins and minerals. Notably, the amount is highly variable depending on the corn type. In general, popcorn is rich in minerals like Mn, P, Mg, Zn and Cu while sweet corn is higher in many vitamins like Pantothenic acid (B5), Folate (B9), pyridoxine (B6), Niacin (B3) and Potassium.

Anti-oxidants

Corn contains a higher amounts and number of anti oxidants (bioactive plant compounds) other than other cereals like Ferulic acid, Anthocyanins, Zeaxanthin, Lutein and Phytic acid.

Health Benefits of Corn

Reduces the risk of anemia

Anemia it is a condition in which there is a lack of red blood cells or of hemoglobin in the blood, resulting in paleness and fatigue. It is the most common bold disorder due to the deficiency of Iron. Corn is rich is in Vitamin B12, Vitamin B6, folic acid and iron (2.71mg), which helps in the production of red blood cells in the body. It helps in reducing the risk of anemia, by supplying enough of the nutrients required to produce fresh red blood cells.

Energy enhancer

Corn contains complex carbohydrate (sugars) and provides instant energy for longer duration of time as it digested at a slower pace. The energy provided by carbohydrates ensures proper functioning of the brain and nervous system.

Miracle for those underweight and overall healths

Maize can be a healthy addition to your meals for gaining weight because it provides healthy calories, lot of vitamins and good quality of fibers. Corn is a good source of thiamin (Vitamin B1) and it plays a key role in the maintenance of brain function. It also helps synthesize acetylcholine, which in turn leads to improved memory. It contains manganese that is beneficial for bone health, diabetes control, boosts metabolism, reduces inflammation and many more. The vitamin B complex prevent the symptoms of rheumatism because they are believed to improve

the joint motility (Huma *et al.* 2019). Potassium is a major nutrient present in maize which has diuretic properties.

Lowers blood sugar & cholesterol level

Corn seed contains an approximately 4% of oil. The consumption of corn/corn oil increases the blood flow, lowers cholesterol absorption and regulates insulin, making it an excellent choice for diabetics (polyphenols, reducing the levels of blood sugar in diabetics) and cholesterol patients (Sen *et al.* 2006). The study revealed that corn oil decreased LDL cholesterol by 11% compared to just 3.5% for extra virgin oil.

Strengthen immunity system

Corn is extremely rich in Vitamin B1, Vitamin B5, and Vitamin C, which helps in fighting diseases and generating new cells. Further, corns are filled with essential minerals like calcium, iron, magnesium, phosphorus, potassium, sodium, and zinc. It will help you to fight against harmful bacteria and viruses by strengthening your immune system. Anthocyanins have been well known for their health-promoting benefits such as anti-carcinogenic, anti-atherogenic, lipid lowering, anti-diabetic, antimicrobial and anti-inflammatory properties.

Helpful during pregnancy

Corn is rich in folic acid, zeaxanthin and pathogenic acid (for healthy functioning of the body organs while pregnancy) which reduce the risk of birth defects in baby. As it contains high amount of fiber helps in digestion and reducing or soothing digestive problems like constipation, which is a very common concern for expecting mothers. Eating corn during pregnancy can protect the baby from muscular degeneration and physiological problems and helpful in healthy brain growth of the fetus because corn contains thiamine.

Maintain wrinkle free skin and healthy hair

Corn oils contains vitamin C and anti-oxidants (lycopene) applied on skin or used in cosmetic products increase the production of collagen and prevent UV generated free radicals from damaging the skin. The vitamin C required to produce a protein known as "collagen" which is a main structural protein found in skin and other connective tissues. This collagen ultimately improves skin elasticity, decrease wrinkles, boost skin moisture and the blood circulation in the scalp thus helps to get stronger hairs and make skin better. Vitamin C also helps your body to absorb iron, and it is an important mineral for hair growth. Oil of maize is used for treating dandruff.

Healthy for eyes:

Dietary intake of lutein and zeaxanthin (two major carotenoids present in maize) reduces the risk of light-induced oxidative damage that could lead to AMD (macular degeneration) by blocking the blue light entering the underlying structures in the retina. High levels of these carotenoids in your blood are strongly linked to a reduced risk of both macular degeneration and cataracts. These carotenoids are divided into two classes: carotenes, which are purely hydrocarbons containing no oxygen and xanthophylls (lutein and zeaxanthin) which are hydrocarbons containing oxygen. Besides age, nutrition is major cause of macular degeneration and cataracts causes of most common visual impairments and blindness. Antioxidants, most notably carotenoids like zeaxanthin and lutein, may boost eye health.

Reduce the risk of cancer

Corns are good source, phenolic flavonoid antioxidants and ferulic acid which plays a crucial part in stopping lung cancer and colon cancer. Corns are rich in fiber (7.3g in per 100g), corn helps lower cholesterol levels and reduce the risk of colon cancer. The beta-cryptoxanthin present in corn helps to promote lungs health and may reduce the risk of lung cancer. The digestible fiber also helps to reduce the risk of diabetes, heart disease, stroke, hypertension and some types of cancer. Lutein also acts as a cancer chemopreventive suppressing agent by presenting inhibitory actions during promotion of disease (Moreno *et al.* 2007).

Ill effects of corn consumption

Corn is generally considered safe. However, some concerns exist limits its consumption.

Antinutrients in corn: Like all cereal grains, whole grain corn contains phytic acid (phytate) which impairs absorption of dietary minerals, such as iron and zinc in our body.

Mycotoxins: Some cereal grains and legumes are susceptible to contamination by fungi. Fungi produce various toxins (mycotoxins) namely fumonisins, aflatoxins and trichothecenes. Fumonisins, that are considered a significant health concern High consumption of contaminated corn is a suspected risk factor for cancer and neural tube defects, which are common birth defects that may result in disability or death.

Corn intolerance: Corn contains proteins known as zein that are related to gluten and caused an inflammatory reaction in a subgroup of people with celiac disease.

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