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POPCORN—“ A HEALTHY NUTRITIONAL SPECIALITY CORN VALUE ADDED PRODUCT ”

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Popcorn is one of the most famous snacks all over the world. It is almost a “must have” in all shopping malls and cinema multiplexes. It is very tasty and has a great flavour which drags us towards it instantly. Given its done in a constrained manner, Popcorn is one of our recommended healthy snacks for any occasion. Popcorn is a healthy wholegrain food and hence it is ideal for snacking between well timed balanced meals. It is generally filling in nature and has energy enhancing carbohydrates. In addition to its taste, it is the popcorn’s nutritional value which makes it such a fantastic snack. It is a very good source of dietary fiber and protein. It is also known for its low sodium and sugar content. Specialty corn has diverse end uses and a number of value-added products can be prepared from it Corn is one of the most diverse grain crop found in nature. Popping is simple and economical processing technique which is traditional and may be adopted easily with the improvement in nutritional quality of grain.

Keywords: Popcorn, Nutritional value, Popping methods, Value addition, Mechanism of popping

INTRODUCTION

Globally, maize is the most important coarse grain cereal and well known as “poor man’s nutria cereal” due to presence of high content of carbohydrates, fats, proteins, and some of the important vitamins and minerals. On the basis of its unique characteristics and nutritional composition specialty, corn is classified into quality protein maize, baby corn, sweet corn, pop corn, green eared corn, high oil corn, etc. Specialty corn has diverse end uses and a number of value-added products can be prepared from it. Quality protein maize (Prasanna *et al.*, 2001; and Singh, 2006) differs from normal maize as it contains added amount of essential amino acids such as tryptophan and lysine. Baby corn is the ear, harvested young when the silks have just emerged and no fertilization has taken place. In sweet corn, the taste of kernels is much sweeter than normal corn. In popcorn when kernels are heated, they explode and

produce large puffed flakes (popping). The value-added products prepared from specialty corns are traditional foods, infant foods, health foods, snacks and savory, baked products, etc. Each specialty corn has different recipes. Apart from these products, maize is used to prepare industrial products such as starch, specialty chemicals, ethanol, refined corn oil, sorbitol, cake mixes, candies, carbonated beverages, and cosmetics (Mandefro Nigussie *et al.*, 2000).

Corn is one of the most diverse grain crop found in nature. The most common types of corn include flint, dent, floury, sugary, popcorn, waxy, multicolored and other types are grown throughout the world with colour, size, kernel shape and other attributes varying significantly. The physical appearance of each kernel type is determined by its pattern of endosperm composition as well as quantity and quality of endosperm. Among the various types of corn

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the most popular being the “popcorn”, is a type of corn (*Zea mays var everta*) that expands from the kernel and puffs up when heated. Popcorn is able to pop like amaranth grain, sorghum, quinoa, and millet. When heated, pressure builds within the kernel, and a small explosion is the end result. Popcorns are usually consumed as snack food with or without salt (regular), sweetened (Chocolate corn) or butter like topping. Popcorn consumption has greatly increased in recent years because of the advent of microwavable popcorn and the proliferation of flavored ready to eat products.

Popping is simple and economical processing technique which is traditional and may be adopted easily with the improvement in nutritional quality of grain. It is a High Temperature Short Time (HTST) treatment which sterilizes product, gelatinizes its starch and develops a pleasant aroma to form a Ready-To-Eat (RTE) at a very low processing cost. Popping process not only retains the actual nutritional profile of grains but also markedly enhances its protein digestibility, bioavailability of iron and dietary fiber content due to the development of resistant starch. Popping also reduces some of the anti nutrients viz., phytates, tannins, acid detergent fiber, lignin and cellulose (Reddy *et al.*, 1991).

TYPES OF POPCORN

Popcorn varieties are broadly categorized based on shape, colour of the kernels and shape of the popped corn. Kernels of maize will be of varied colours, but popped corns is always off- yellow or white as it is only the hull (pericarp) that is coated.

1. Rice type popcorn: It has a long kernel pointed at both the ends, white in colour
2. White “pearl” type kernels are rounded at the top,

Commercial popcorn production has moved mostly to pearl types. Traditionally pearl popcorns were yellow and rice popcorns white in colours. However variegated colours like black, red are also cultivated in many parts of the world. Commercial productions are dominated by white and yellow.

SHAPES OF POPCORN FLAKES/KERNELS

1. Mushroom popcorn shaped flakes
2. Butterfly popcorn shaped flakes

Mushroom Kernels

- Compact, ball shaped popcorn.
- Larger, denser, less fragile than butterfly kernels.

- The consistently round shape provides a larger surface area to which a coating can stick.
- Most often used in gourmet popping applications where caramel, cheese, chocolate, or other coatings are applied.
- Kernel of choice for making kettle corn.

Butterfly Kernels

- Irregular shape with many fragile wings protruding from each kernel.
- More tender, light, and fluffy than mushroom kernels.
- Most often used in movie theaters, stadiums, carnivals.
- Non-uniform shapes allow you to fill serving sizes with less product to maximize profits.

Normally popped kernels (flakes) found in two major shapes that are “mushroom” flakes are more of ball shaped with few wings and “butterfly” flakes with protruding wings. Butterfly shaped popcorns are regarded as having better mouthful with greater tenderness and less noticeable hulls than the mushroom shaped popcorns. The mushroom flakes have higher bulk density than butterfly, are generally preferred in the confection industry as they are less susceptible to breakage and easier to coat with flavors or syrups. Butterfly shaped popcorn has a better mouth feel and is preferred for on-premises popping such as theaters.

Popped grains are good in terms of energy, carbohydrates, fat, fiber, protein and iron. Since popcorns are prepared out of whole grains, which are rich in many components including dietary fiber, starch, fat and this fat or lipids consisted primarily of linoleic, oleic and palmitic acids. Apart from this popcorn do contain other antioxidants, nutrients, minerals, vitamins, lignin and Phenolic components all of which have been linked to reduced risk of different types of cancer. Most of these protective component are found in the germ and bran which are reduced in almost all the grains due to refining process. However popping is one such technique of grain processing where in the germ and bran portions are retained, and it is the most simplest and economical method of processing which imparts a pleasant aroma and flavor that can be enjoyed at all times. Apart from above advantages popping of grains enhance the acceptability of cereals as well as millets (Rakshit *et al.*, 2003).

Popcorn is used primarily for human consumption as a favorite nutritious snacks food and is becoming more and more popular overtime. Most of the popcorn is popped in

home at domestic levels and the remaining is sold through retail outlets, fast food shops and also by confectionery industry (yenagi *et al.*, 2004). Since popcorn and its products are cereal based snack foods and always been an important part of life and these products represent an important segments of the food industry worldwide especially in developing countries.

Now a day’s snack food market is continually changing and adapting to the new consumer needs. Commercial food manufactures produce an array of Ready To Eat (RTE) as well as convenient foods, which are high in oil and flavored with salt or salty flavorings. The simpler snacks can be produced from popcorn in a natural way with high nutritional benefits. It is high time that measures be taken up for value addition to pop grain by simple and economical technique of popping and value addition that could create tasty and nutritious food which would further enriches the popped grains.

NUTRITIONAL VALUE OF POPPED GRAINS

Content	Amount (Typical)
Calories	93
Calories from fat	10
Carbohydrates	18.7 g
Dietary fibre	15 g
Protien	3.1 g
Iron	2.7 mg
Cholesterol	0 mg
fat	1.1 g

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Popcorn is a healthy wholegrain food and hence it is ideal for snacking between well timed balanced meals. It is generally filling in nature and has energy enhancing carbohydrates. In addition to its taste, it is the popcorn’s nutritional value which makes it such a fantastic snack. It is a very good source of dietary fiber and protein. It is also known for its low sodium and sugar content (Kawatra and Sehgal, 2007).

RAW POP CORN

Popcorn grains are normally smaller than the regular dent corns with a glossy coating. Moisture is one of the most important parameter which affects yield and stability during storage. Popcorn is less affected by moulds compared to regular dent corns. Popping quality especially expansion volume depends on moisture, hardness and average size of the grain. Generally lower sized kernels produce less expansion volume than larger ones. Stress cracks are created due to faulty harvesting with rapid drying and tend to produce higher incidence of un-popped kernels with less flake volume. For a good quality moisture content of the grains should be around 14%. If the grains are too dry then moisture content is increases by adding known quantity of water and conditioning the grain until desired level of moisture is attained.

Popped Grain: Optimally the minimum moisture to preserve crispiness is less than 2%. Moisture also affects the texture of popped grain and hence must be consumed at a moisture level lower than 2% (ideally 1.7-1.8%).

MECHANISM OF POPPING

Kernel of popcorn contains certain amount of moisture and oil. Unlike most other grains the outer hull of popcorn kernels is strong and impervious to moisture while starch is hard and dense type. When the kernels are heated moisture present in the kernel gets converted to pressurized steam as a result the starch inside the kernel gelatinizes, softens and becomes pliable. At a pressure of about 135 psi (930 K.Pa) and a temperature of 180-232 °C (356-450°F) the breaking point of the hull is reached. The hull ruptures rapidly causing a sudden drop in pressure inside the kernel with a corresponding rapid expansion of the steam, expands the starch and proteins of the endosperm into crispy puffs popularly known as popping (Edmund and Looyd, 2001). Only the strain of “*Zea mays var everta*” which as special kind of flint corn with varied proportion of hard and soft starch in the endosperm will bear the characteristics popping quality (Ramachandreappa and Nanjappa, 2006).

POPPI NG OR COOKI NG METHODS

Traditionally popcorn is popped on an iron tawa over an open flame. But during recent past a number of popcorn machines are available in the market in varied size and shapes. The most convenient one of small scale (house hold) consumers is “air poppers” which rapidly circulate heated air up through the interior part by keeping the un-

popped kernels in motion to avoid burning and then blowing the popped kernels out through the chute. The majority of popcorn sold in the market is now packed in microwave bags which can be conveniently used in microwave oven. The common popping methods include.

Oil Popping: Traditionally salted popcorn is made by putting corn in a pot or iron tawa with oil and salt along with heating and shaking until popping is completed. The level of heat applied to the pot must be controlled so that the popping process takes about 2.5 minutes from cold start with oil and corn. If oil is preheated as some operators prefer the popping time will be only about 1.5-2.0 minutes.

Dry Popping: Hot air poppers are popular in houses where consumers are concerned about fats and oils in their diet and also it require little preparations. Small hot air-home poppers operate on the principles of forcing heated air up through a bed of popcorn until it popped. The popped corn may then be seasoned with salt, butter or any other flavors as desired.

Microwave Popping: Microwaving is probably the easiest way to prepare popcorn which requires the least clean up but is the most expensive in cost per serving. Raw popcorn and oil are packed in a specially designed package that is placed in a microwave oven and heated. Directions are printed on microwave popcorn packages and these packages contain disposable serving containers for the finished product.

YIELD OF POPCORN

Good popping is directly proportional to the rate at which the kernels are heated, if heated too quickly the steam in the outer layers of kernel can reach high pressure and rupture the hull before the starch in the center of the kernel can fully gelatinize leading to partially popped kernel with hard centers. On the other hand, heating too slowly leads to entirely un-popped kernels due to leakage of moisture from the tip. Producers and sellers of popcorn consider two major factors in evaluating the quality of popcorn (popping characters) viz. popping percentage (%) and volume of expansion. Expansion or volume is more important for both the vendor and consumer point of view. The conventional manner of reporting expansion volume has been the ratio of pop volume (ml) per weight (g) of the popped volume (ml) and number of popped kernels. The percent un-popped kernels is determined by measuring the number of un-popped kernels/original number of kernels) x 100 (Sergio O Serna-

Saldivar, 2012). For the consumer, larger pieces of popcorn being tender are associated with higher quality while for producer, distributor and vendor expansion is closely related to profit. Vendor buys popcorn by weight and sell it by volume; hence higher expansion popcorn fetches a higher profit per unit weight. Good popcorn has a 40:1 popping ratio (Volume of popped corn to volume of un-popped corn) and 98% popped kernels and a test weight of 810 g/l. popping characteristics are affected by moisture content of the grain while eating quality is affected by moisture content of popped flakes. Grains with 14% moisture are considered optimum for popping (Venkatesh *et al.*, 2003).

Higher pop expansion volume is found to be correlated with desirable consumer attributes including improved texture and consumer acceptability. Some of the phenotypic characteristics shown to affect pop volume include physical traits such as kernel size, shape, density, hardness and pericarp thickness as well as composition attributes such as level of zein protein and types of fatty acid in the kernel. Popcorn kernels with large amounts of hard endosperm will have greater expansion ration (Jess *et al.*, 2012). Although conditions for growing popcorn are the same as for dent con, special harvesting and specific drying and storage practices are necessary to maintain popping quality.

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