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Functionality of pizza ingredients

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Abstract

Purpose – This paper aims to review the types of pizza and the functionality of basic ingredients of pizza with special focus on the effects of pizza toppings on health.

Design/methodology/approach – Phenomenological research has raised awareness and increased insight into the role of various pizza ingredients and health benefits of different pizza toppings and consequently pizza is called a "functional food". The approach is based on observation of the online research, a close watch on the pizza industry, analysis of research papers in journals, and brainstorming research on the effect of packaging on the quality of different pizza ingredients with a co-researcher for four years.

Findings – The changing life patterns and food habits of people and their preferences have catapulted the market to grow for convenience and fast foods. Pizza is one of the most popular family foods worldwide and has gained widespread consumer acceptance as a healthy and convenience food. It is a multi-component product with composite number of toppings. It provides an array of nutrients in significant amounts, in relation to its energy and fat content, making it a nutrient-dense food. It is cheap and can be delivered in a very short time. In particular, pizza supplies 30 per cent of the USA recommended daily allowance of vitamins A, C, B_2, calcium and protein. It contains 50 per cent of vitamin B_1 and 35 per cent of iron. Furthermore, pizza has anticancerous effects beyond the basic nutrition it provides, because of the potent antioxidant lycopene present in tomatoes.

Originality/value – This paper offers a holistic view that would guide a reader to identify the beneficial effects of pizza.

Keywords Pizza, Lycopene, Anticancer fighting food, Convenience foods, Fast foods, Nutrition

Paper type General review

Introduction

The food industry has gone through many changes in the past two decades, mostly due to the development and implementation of new technology to meet growing consumer demands for convenience products. Current consumer trends bode well for companies able to develop healthy foods that taste good, are good for people, and are also good for on-the-go eating. Only 60 percent of all meals today are prepared and eaten in the home, largely because the increasing number of two working parent and single-parent households means less time to cook. Pizza, one of the most commonly purchased items in retail food stores, has maintained its market share through the changing nature of the processed foods industry and even grown in popularity. With pizza being one of the more popular consumer foods, pizza markets in Europe, America, and other continents have been boosted by the trend towards international cuisine and convenience foods. As a result, pizza production has been increasing at unprecedented momentum, and is expected to increase further in the next decade in response to a growing world population (Lemki and Ferris, 2001).

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Pizza is one of the most world-famous Italian dishes because of its simplicity, taste, and nutritional value. Pizza is a round oven-baked pie made with crisp yeast dough, which in the past was covered with tomato sauce, mozzarella cheese and a variety of other ingredients. Now, it can be covered with a variety of savoury ingredients that may include sauces, meats, vegetables and cheeses. The market now offers a vast array of pizza to suit all palates and meal occasions with different shapes and flavours and, more recently, health attributes and is available all year-round. This versatility, together with their acceptance as a healthy and nutritious food, has led to its widespread popularity across all population subgroups. America is the new pizza renaissance leader in the world and is exporting technology of pizza production and promotion on an ever-increasing basis (Pierce, 2006).

Types of pizza

Pizzas are available in various styles. It is generally seen at common pizza chains, pizza crusts topped with apples or cherries, or corn meal crusts topped with different types of vegetables, sauces, cheese, and other stuffs. The most popular styles of pizza are:

- *Traditional crust pizza.* The crust is not too thick and not too thin. It is made by rolling the dough into a round circle then topping it with sauce and cheese.
- *Deep dish pizza.* A thin crust and dense toppings usually characterize deep-dish pizza, also known as pan pizza. Baking time tends to take longer. However, one slice might make a meal for many people.
- *New York style pizza*. Typically the thin crust allows faster cooking but less dense toppings.
- *Calzone.* This is basically a stuffed pizza crust. The uncooked crust is filled with traditional toppings then folded and baked.
- *Pizza bread.* The French bread loaf is usually sliced down the centre into two halves. The sauce, cheese and toppings are then placed on the flat, sliced surface.
- *Bagel Pizza.* Made much like the French bread pizza but with bagel slices instead.
- *Sweet pizza.* A dessert form of pizza which is topped with a variety of nuts, candid fruits, citrus and sweet flavourings.
- *Frozen pizza.* It is popular because of its ease to prepare. This is perfect food for the person that hates to cook but wants a cheap and inexpensive pizza. Montgomery (1969) quoted that frozen pizza has the greatest penetration among all frozen prepared foods. Benner (1983) reported USDA standards for frozen pizza that it must contain at least 12 percent cheese, and meat pizzas contain at least 12 percent cooked meat. Wilmes (1987) studied the frozen pizza product with a special baked pastry shell produced from dough containing a specified mixture of high and low protein wheat flours. The dough also contains 10-17 percent solid fat having melting point in the range 48-53°C, and is mixed in such a way that the fat remains in solid pieces prior to baking. After baking and topping with pizza sauce the product is frozen. Subsequently, final re-baking by the consumer gives a crust, which is tender inside and crisp on the bottom. The market for frozen pizza accounts for approximately 19 percent of the sales for all prepared foods.

Functional, medicinal, therapeutic and nutritive value of pizza

While some people look at pizza and perceive it to be low in nutritional value, published data (Silvano *et al.*, 2006) indicate that just the opposite is usually true. Most pizzas are actually quite high in nutritional value. They offer a good source of protein, complex carbohydrates, vitamins and minerals, and they are fairly low in caloric density. The protein content of pizza often appears to range from about 10 percent to just a little more than 14 percent. Due to the fact that the majority of this protein comes from the cheese and meat toppings, this protein is of a high nutritional quality, which is important to growing children. Research has shown that the fat content of most pizza rarely exceeds the 10 percent level. On top of all this, because vegetable oil, olive oil, and oil-based shortenings are commonly used in the crust formulation, pizza and pizza products (calzone and bread sticks) are good sources of polyunsaturated fats, with only modest cholesterol contributions (through meat and cheese toppings) to the diet. Pizzas are quite high in complex carbohydrates, primarily from starches, making it a good energy food. On the other hand, pizzas tend to be low in fibre content. This is especially true when regular white pizza flour is used in making the crust. When a whole wheat or multi-grain flour is used, however, the fibre content of the pizza can be improved significantly (Ghosh and Kanawjia, 1986).

Anon. (1974) reported that pizza supplies 30 percent of the US Recommended Daily Allowance (RDA) of vitamins A, C, B_2, and Calcium and protein. It contains 50 percent of the RDA of Vitamin B_1 and 35 percent of iron. Martin (1977) observed that pizza ranks extremely high in wide spectrum of nutrients; rich in protein and Calcium (fulfil 127 percent daily needs); an excellent source of iron (supplies 50-55 percent of daily requirements); provides 30 percent needed niacin; contain 26-42 percent adult vitamin A quota; provides 900-1150 calories/pizza. Scientists in Italy (Silvano *et al.*, 2006) have found that a regular consumption of pizza may reduce the risks of cancer to the digestive tract. They also found that the people who ate the most pizza had the fewest cases of cancer. In a group of nearly 8,000 there were 598 cases of oral and pharyngeal cancer. Out of this group, 310 ate no pizza at all, 213 occasionally had pizza. Only 75 were regular pizza eaters. The results for colon cancer followed the same trend. Out of 1,225 patients with colon cancer, the number who ate no pizza was 503. Those who ate pizza up to three times a month had 473 of the cases of colon cancer. Regular pizza-eaters were 59 percent less likely to contract cancer of the oesophagus, and 26 percent less likely to develop cancer of the colon.

Basic ingredients of pizza

Several ingredients can be used for the production of bread, the most important of which are flour, yeast and water. As soon as dough is properly baked into bread, a product with superior quality and sensory features occurs. Fresh bread usually presents an appealing brownish and crunchy crust, a pleasant roasty aroma, fine slicing characteristics, a soft and elastic crumb texture, and a moist mouthfeel. The pizza industry is very large all over the world, thus there are many toppings varies from country to country. The toppings that can be put on pizza:

- Vegetables: tomatoes, peppers, mushrooms, olives, onion, chillies, garlic, broccoli, Asparagus (Sharma and Caralli, 2006).
- Meats: pepperoni, bacon, ham, ground beef, salami, and chicken.

The functional role of essential pizza ingredients are discussed in the following sections.

Flour

Pizza is a flat pie made from bread dough. Pizza dough can be chemically (Lehman, 1997) or yeasts leavened (Coppola *et al.*, 1998). Flour is the basic ingredient in the production of bakery goods. There are various types and qualities of flour with different protein quantities and qualities. Because of a process of freezing, storing, and thawing, flour for frozen doughs should have a good strength and high protein content (Wolt and D'Appolonia, 1984a, b). In many cases, flours from hard wheat varieties, with a protein content of 11-14 percent, are recommended for use in frozen dough products. The flour with the higher protein content (13.2 percent on flour basis) caused higher values in volume, especially with increasing storage time. Flour with lower protein content, as used in frozen doughs, could be strengthened using vital gluten (Wang and Ponte, 1994). Glutenin played a predominant role in the baking quality of frozen doughs. The gliadin and starch fractions contributed significantly to frozen dough quality but not as much as the glutenin fraction. Pizza dough can be a good source of antioxidants and through certain baking techniques, antioxidants in the dough can actually be increased. The new research by Micelli (2007) to find ways to improve antioxidant properties from whole-grain flour demonstrated the effect of different baking conditions on the antioxidant levels in pizza dough and found that longer baking times or higher temperatures generally corresponded to higher levels of antioxidants in comparison to less-intense baking conditions. The overall quality of a pizza depends mostly on the leavening, the flour used, and the preparation procedure (Coppola *et al.*, 1998). The formulation of crust has been reported by several workers is presented in Table I.

Water

Water is another essential ingredient in bread making. During the mixing process, added water becomes distributed between the flour components, such as gluten, starch and pentosans. The rest of the added water remains as "free" water and forms the so-called water phase. Soluble compounds such as salts, sugars, and soluble proteins

Ingredients	Federico (1974)	Westover (1980) %	Ghosh and Kanawjia (1986) %
Flour	100 lb	60.65	60.0
Water	78.4 lb	36.04	34.0
Yeast	4.5 lb	1.28	3.0
Salt	7.0 oz	0.93	1.0
Sugar	9.0 lb	–	1.0
Vegetable oil	–	–	1.0
Soya oil	–	0.80	–
Olive oil	–	–	–
Emulsifier	–	0.30	–
Shortening	4.5 lb	–	–
Dried whey	1.5 lb	–	–
Eggs	2.0 lb	–	–

Table I.
Formulation of crust

are dissolved, and yeast cells are dispersed in this water phase. Since free water is damaging in a dough system and yeast is sensitive to water during freezing and thawing cycles, lower levels of water absorption are desirable for frozen doughs. The amount of water absorbed into the dough is mainly controlled by the quality of flour. Therefore, the type and quality of the flour are key factors in water absorption. High quality flour ensures maximum water absorption and retention of the moisture during dough processing for baked products (Stear, 1990; El-Hady *et al.*, 1996). Since free water damages the dough system and yeast is sensitive to water during freezing and thawing cycles, lower levels of water absorption are desirable for frozen doughs. Loaf volumes not only depend on the amount of water added to dough, but also on the mixing time applied. Furthermore, baking adsorption and mixing time are interdependent. Therefore, for the best loaf volume both baking adsorption and mixing time should be optimized (Sideleau, 1987).

Yeast

Yeast has three fundamental functions in dough systems. It produces CO_2 by fermentation, which expands the dough to the required volume. It also develops the dough through the action of fermentation on the gluten structure. Moreover, it provides flavour through the production of complex chemical compounds as by-products of the fermentation process (Stear, 1990; Sultan, 1990). A yeast level used in the baking process is around 3 percent (on flour basis). A level of yeast in the dough directly affects the rate of gas production. Furthermore, the yeast level used in dough processing depends on the bulk fermentation time and dough temperature. The longer the bulk fermentation time the lower the yeast level should be. As dough temperature increases, so does the rate of gas production until the optimum temperature at about 40°C is reached. Above that temperature a progressive thermal killing of the yeast can be observed (Stauffer, 1990). The major problem of frozen doughs is the performance of the yeast (Hino *et al.*, 1987). Much higher levels of yeast (6 percent-8 percent on flour basis) have a deleterious effect on the flavour and aroma of baked goods prepared from frozen doughs (Lorenz and Bechtel, 1965).

Salt

The salt normally used by bakers is table or cooking salt (NaCl). On average, bakers use 1.5-2 percent salt based on the weight of the flour. The primary function of the salt in fermented baked products is to add flavour. Salt also has some technological functions, such as to increase dough stability, firmness, and capacity to retain fermentation gases. Salt has a specific effect on fermentation: the higher the concentration of salt, the lower is the rate of fermentation with the same yeast level, and vice versa. Moreover, salt has a strengthening effect on the gluten network during fermentation of the dough (Stear, 1990; Sultan, 1990).

Sweeteners

The most common sweetener in the baking industry is sucrose even though brown sugar, dextrose, maltose, molasses, corn syrup, and invert sugar are frequently used in baked goods. In addition, the perceptible sweetening effect varies between various sugars (Sultan, 1990). Sugar is often added to fermented products for flavouring reasons and to promote a pleasant crust colour. Moreover, added sugar provides a good

grain and improvement in the crumb and crust of baked goods (Woods, 1985). Sugar is the basic source of energy, which yeast converts into carbon dioxide during dough fermentation. Even though doughs can be made without sugar, an average amount of sugar is 3 percent-6 percent based on the weight of the flour. The sugar concentration chosen depends on the type of product and desired crust characteristics (Stear, 1990; Sultan, 1990). Sugar levels used in frozen doughs also depend on the type of product the bakery is producing. A slightly higher concentration of sugar (8 percent-10 percent on flour basis) than in conventional baking is recommended for frozen dough production. The higher level of sugar in frozen doughs is desirable because of the hygroscopic properties of sugars, which increase the amount of water absorbed. Therefore, the amount of "free" water in dough is decreased and can reduce the yeast damage before the final baking (Stauffer, 1993).

Shortening

Different types of shortening are used in baked foods, such as standard fats, oils, and other shortening combinations. In general, shortening improves the crumb properties of baked bread and the dough volume. Moreover, the texture of baked products is changed to give a shorter and softer bite (Sultan, 1990). Dough's containing shortening continues to expand during baking for a longer time. Therefore, the final volume of baked products is larger with added shortening (Junge and Hoseney, 1981). The addition of shortening at a level of 0.7-1 percent of the flour weight is required for significant improvements in frozen dough production and bread quality. A higher shortening level is recommended for good quality frozen doughs and incorporation of shortening as 40 percent oil in water (O/W) emulsion system improved particularly frozen dough stability and final loaf volume (Inoue and Bushuk, 1992).

Ascorbic acid

Oxidants are used to improve the structure and loaf volume of the dough, and to increase dough strength. Because of the death of yeast cells during frozen storage, reducing substances (particularly glutathione) are formed, which lead to some gluten weakness as a result of weakened disulfide bridges that are essential in stabilization of the gluten network (Stauffer, 1993). Therefore, more oxidants are needed to compensate for this reducing action in the frozen dough production. Ascorbic acid has been widely used as an oxidant in the baking industry. The amount used for good dough processing is 10-200 ppm, based on flour weight, and it depends on the desired effects on the quality of baked goods (Stear, 1990; Inoue and Bushuk, 1996; Woods, 1985). The combination of ascorbic acid and potassium bromate is often used to improve the quality of baked goods, because it has been shown that it allows even greater improvement than ascorbic acid alone (Varriano *et al.*, 1980; Lu and Grant, 1999).

Mozzarella cheese

Mozzarella cheese is an integral part of pizza toppings. One of the best part of the pizza is mozzarella. Other cheeses can also be added. The cheese is supposed to go on top of the pizza immediately after the sauce. It should be grated and not sliced so that it will melt more evenly (Mann, 1997). Mozzarella cheese belongs to "Pasta Filata" variety of cheese, which involves skilful stretching, pulling and kneading the curd under hot water to arrive smooth texture and grain in cheese. An ideal mozzarella cheese has

smooth, moist surface with a perfect sheen and an elastic, stringy body free from mechanical opening (Apostolopoulos, 1994). Mozzarella cheese provides mild flavour, visual appeal and characteristic texture when melted on the surface of a pizza. Mozzarella melts smoothly and browns nicely when baked. The melted cheese is very elastic and is very stretchy and stringy, contributing to the sensory appeal and "fun factor" (Kosikowski, 1981). There are two types of mozzarella that are acceptable for pizza: low moisture, which has a moisture content less than 52 percent, and high moisture, which has a moisture content of more than 52 percent. The low moisture version tends to have a longer shelf life. The latter is more popular for the pizza and restaurant industry.

Tomato sauce

Anon. (2003) reported, "Tomato sauce protects many types of tumour". Nutrition experts believe that the functional components of food that may reduce the risk of cancer include traditional nutrients such as lycopene in tomatoes, have antioxidant properties, which protect cells against damage from oxidation. The key: tomato sauce, super-rich in the antioxidant lycopene, which may help save you from heart disease, prostate cancer and Alzheimer's disease, according to many studies. Lycopene is more bioavailable from tomato paste or sauce than from fresh tomatoes (Gartner *et al.*, 1997; Tonucci *et al.*, 1995). Physico-chemical composition of tomato sauce: moisture 78.4 percent, total soluble solids (TSS) 21.0 °Brix, total solids 21.6 percent, acidity 0.92 (percent acetic acid), pH 3.88, salt 3.71 percent, viscosity 5750 Cp, ascorbic acid 3.39 (mg/100 g) and lycopene 3.30 (mg/100 g) (McGlasson, 1993; Beecher, 1998).

Tomato

It is one of the most popular and widely grown vegetable crops in the world. Ripe tomato fruit is consumed fresh and utilized in the manufacture of a range of processed products such as puree, paste, powder, ketchup, sauce, soup, and canned whole fruits (Southon, 2000). Tomatoes are important sources of lycopene and vitamin C and are valued for their colour and flavour (Madhavi and Salunkhe, 1998). Tomato has many medicinal values. The pulp and juice of the fruit is easily digestible, appetiser, promoter of gastric secretion and a blood purifier. It is also considered to be an intestinal antiseptic as it has a cleaning effect in the enteric portion of the alimentary canal. It is mild and natural stimulant that helps to wash away the toxins. It is richest of all the vegetables in natural health acids, which keep our stomach, and intestines in good condition. It is mild and natural stimulant that helps to wash away the toxins. It is also useful for the patients of bronchitis and asthma (Cook-Mozaffari *et al.*, 1979). Benito *et al.* (1990) classified tomatoes in subgroup of low-fibre vegetables that is significantly protective against cancer of the colon and rectum. In a recent epidemiological study, Franceschi *et al.* (1994) reported the positive effects of tomatoes on the risk of digestive tract cancers. Lycopene content of tomato has been reported to enhance resistance against total body x-ray irradiation, and survival rates of mice exposed to x-ray irradiation.

This carotenoid found in tomatoes (and everything made from them) has been extensively studied for its antioxidant and cancer-preventing properties. The antioxidant function of lycopene – its ability to help protect cells and other structures in the body from oxygen damage – has been linked in human research to

the protection of DNA (our genetic material) inside of white blood cells. The interest in the possible anticancer properties of carotenoids, and more recently lycopene itself, is based not only on a sound scientific basis but also on a wealth of epidemiological data from around the world. The strength of the evidence is such that the US National Research Council (1989), the NCI (1987), and the World Cancer Research Fund (1997) have all recommended increasing dietary intake of citrus fruits, cruciferous vegetables, green and yellow vegetables, and fruits and vegetables high in vitamins A and C to lower cancer risk. Lycopene is one of the most potent antioxidants (Miller *et al.*, 1996; Mortensen and Skibsted, 1997; Woodall *et al.*, 1997; Singh and Goyal, 2008), with a singlet-oxygen quenching ability twice as high as that of β-carotene and 10 times higher than that of α-tocopherol (Di Mascio *et al.*, 1989). It has attracted attention due to its biological and physicochemical properties, especially related to its effects as a natural antioxidant. This makes its presence in the diet of considerable interest. Increasing clinical evidence supports the role of lycopene as a micronutrient with important health benefits, because it appears to provide protection against a broad range of epithelial cancers (Giovannucci, 1999). In the area of food and phytonutrient research, nothing has been hotter in the last five years than studies on the lycopene in tomatoes (Shi and Le Maguer, 2000). Levy *et al.* (1995) showed lycopene to be a more potent inhibitor of human cancer cell proliferation than either α-carotene or β-carotene. A high tomato intake in an elderly American population was similarly associated with a 50 percent reduction in mortality from cancer at all sites (Colditz *et al.*, 1985). Tomato lycopene extract supplementation decreases insulin-like growth factor-I levels in colon cancer patients. Epidemiological studies have shown that high serum levels of insulin-like growth factor-I are associated with an increased risk of colon and other types of cancer (Walfisch *et al.*, 2007). The biochemical mechanisms underlying the health-promoting roles are not fully understood, although the antioxidative activity of lycopene (Rao and Agarwal, 1999), which has been shown to be a potent protector against oxidative damage to DNA, protein and lipids, is thought to be primarily responsible. Other activities of lycopene such as modulation of cell-cell communication (Zhang *et al.*, 1991), inhibition of cell proliferation, and resistance to bacterial infections may also be involved. Yaping *et al.* (2003) suggested the health-promoting roles of lycopene with its anti-inflammatory and anticoagulant activities.

Colorectal cancer. A study conducted by Erhardt *et al.* (2003) revealed that in patients with colorectal adenomas, a type of polyp that is the precursor for most colorectal cancers, blood levels of lycopene were 35 percent lower compared to study subjects with no polyps. Blood levels of β-carotene also tended to be 25.5 percent lower, although according to researchers, this difference was not considered to be significant. In their final (multiple logistic regression) analysis, only low levels of plasma lycopene (less than 70 μg/L) and smoking increased the likelihood of colorectal adenomas, but the increase in risk was quite substantial: low levels of lycopene increased risk by 230 percent and smoking by 302 percent. All raw vegetables had a clear protective effect for both colon and rectal cancer (Tuyns *et al.*, 1988).

Prostate cancer. The role of diet and dietary supplements in the development and progression of prostate cancer represents an increasingly frequent topic of discussion (Barber and Barber, 2002). The public and the biomedical community are increasingly aware of associations between tomato products, lycopene, and health outcomes. Scientists from many disciplines ranging from epidemiology, clinical medicine, nutrition,

agriculture, and molecular and cell biology have published peer-reviewed studies providing intriguing data suggesting that tomato products and the carotenoids lycopene may be involved in cancer prevention, reducing the risk of cardiovascular disease, and limiting the morbidity or mortality of other chronic diseases (Miller *et al.*, 2002). Carotenoids may react with oxygen-free radicals by either transfer of the unpaired electron leaving the carotenoids in an excited triplet state, the excess energy being dissipated as heat, or by "bleaching" of the carotenoids. The former leaves the carotenoids intact and therefore able to be involved in numerous cycles of free radical scavenging, and the latter results in decomposition of the carotenoids. Fortunately, it is the former that predominates, and the efficiency of this process seems to be related to the number of double bonds incorporated in the carotenoids structure. Interest has been heightened in lycopene, in particular, as it has a large number of double bonds and thus has been found to be the most potent scavenger of oxygen-free radicals of all the carotenoids (Rao *et al.*, 2003). Lycopene has also been demonstrated to have other possible anticancer properties particularly relating to modulation of intercellular communication and alterations in intracellular signalling pathways (Stahl and Sies, 1996). These include an upregulation in intercellular gap junctions (Zhang *et al.*, 1992), an increase in cellular differentiation (Bankson *et al.*, 1991), and alterations in phosphorylation of some regulatory proteins (Matsushima-Nishiwaki *et al.*, 1995). In prostate cancer, in particular, a study has demonstrated inhibition of cell line proliferation in the presence of physiological concentrations of lycopene in combination with α-tocopherol (Pastori *et al.*, 1998). Lycopene is present in the human prostate at significant concentrations, and recent studies suggested that men with higher concentrations of blood lycopene experience a lower risk of prostate carcinoma (Clinton, 1999).

Pancreatic cancer. One of the deadliest cancers, pancreatic cancer progresses so rapidly that individual with the disease who are participating in studies often die before their interviews can be completed-so the benefits noted in the following study of a diet rich in tomatoes and tomato-based products are especially significant. In a yhree year Canadian study done by Nkondjock *et al.* (2005), 462 persons with pancreatic cancer were age- and gender-matched with 4,721 individuals free of the disease. After adjustment for age, province, body mass index, smoking, educational attainment, dietary folate, and total caloric intake, the data showed men consuming the most lycopene, a carotenoids provided mainly by tomatoes, had a 31 percent reduction in their risk of pancreatic cancer.

Coronary heart diseases. The lycopene in tomatoes may also provide cardiovascular benefits. Epidemiological studies have also supported the hypothesis that consumption of heat-processed tomatoes may reduce the risk of coronary heart diseases as the lycopene interferes passively with oxidative damage to DNA and low-density lipoproteins (Gester, 1997; Clinton, 1998; Hadley *et al.*, 2003). Lycopene's ability to act as an antioxidant and scavenger of free radicals that are often associated with carcinogenesis is potentially a key to the mechanism for its beneficial effects on human health (Khachik *et al.*, 1995). Researchers suggest that in addition to its inverse association with various cancers, a high dietary consumption of lycopene may play a role in cardiovascular disease prevention. Visioli *et al.* (2003) reported that when a group of 12 healthy women ate enough tomato products to provide them with 8 mg of lycopene daily for a period of three weeks, their LDL cholesterol was much less susceptible to free radical oxidation, the first step in the formation of atherosclerotic

plaque forma formation and a major risk factor for cardiovascular disease. Lipophilic compounds contained in tomato can prevent cardiovascular diseases by modulating the atherogenic processes in vascular endothelium mediated by oxidized low-density lipoproteins (LDLs).

Onion

Onion belongs to the genus *Allium*, which includes several cultivated crops such as onion, garlic. Its spice value is due to sulphur compounds. Onion is used to treat stomach ulcers, eye disorders, gastrointestinal disturbances, high blood pressure, malarial fevers, and intestinal worms. The onion is known to possess insecticidal, antifungal, antibacterial, antitumor, hypoglycaemic, hypolipidemic and antiatherosclerotic properties. This has been attributed to its sulphur containing compounds (Augusti, 1990).

According to MacGillivray (1953), onion contains 87.5 percent water, and the food value per 100 gm of edible portion is energy 49 calories, protein 1.4 gm, calcium 32 mg, vitamin A 20 IU, ascorbic acid 12 mg, thiamine 0.03 mg, riboflavin 0.12 mg and niacin 0.1 mg. In sixth century in India, onions were used as a diuretic. They were also considered beneficial for the heart, the eyes, and the joints. During Colonial times in the USA, a slice or two of wild onions was thought to be a cure for the measles. In Chinese medicine, globe onions (*allium cepa*) are said to calm the liver, moisten the intestines, and benefit the lungs. Raw onions are prescribed for constipation, for lowering high blood pressure, and for healing wounds or ulcers of the skin. Spring onions, or scallions *(allium fistulosum)*, are used to induce sweating. Some health studies have shown raw onions to be effective in lowering overall cholesterol while raising HDLs, the good cholesterol. Additionally, onions kill infectious bacteria, help to control blood sugar, aid in dissolving blood clots, and help to prevent cancer. At the University of California at Berkeley, researchers found that yellow and red onions, along with shallots, contain quercetin, a powerful antioxidant that acts as an anti-cancer agent to block the formation of cancer cells. One and one-half to three and one-half ounces of raw onions eaten regularly contain enough quercetin to offer cancer protection. White onions lack this antioxidant. They also learned that quercetin deactivates the growth of estrogen-sensitive cells often found to cause breast cancer. Asthma sufferers may also benefit from a hearty dose of onions. Researchers discovered a sulphur compound contained in onions that can prevent the biochemical chain reaction that leads to asthma attacks. Selenium, a trace mineral found in onions and garlic, has also demonstrated anti-cancer abilities. In addition to prostate cancer, selenium may lower the risk of breast, colorectal and lung cancers. It has been documented that in areas of high garlic and onion consumption rates of stomach cancer are relatively low. There is mounting evidence that members of the onion family have a positive effect in lowering incidences of heart disease.

Pepper

Capsicum, *C. annum var. grossum* (sweet pepper, bell pepper), is widely cultivated vegetable crop worldwide. The larger bell-shaped fruits with thick pericarp are less pungent or nonpungent and used in the fresh condition as a vegetable, in salads and in pickles. Bell pepper, both green and red are eaten raw or after cooking. They are used in salads, in stews for imparting flavour, pizza, meatloaf, dehydrated processed meat,

and for canning (Rajput and Parulekar, 1998). Bell or sweet peppers are very rich in vitamins A and C and they are also good source of β-carotene. Bell pepper contains 48 kcal energy, 2.0 g proteins, 0.8 g fats, 10 g carbohydrates, 2.6 g fibre, 29 mg calcium, 61 mg phosphorus, 2.6 mg iron, 0.12 mg thiamine, 0.15 mg riboflavin, 2.2 mg niacin, 140 mg ascorbic acid per 100 g edible portion (Bernal *et al.*, 1993).

Olives

The occurrence of biophenolic components in olives provides functional value to the Mediterranean food culture, owing to recognized antioxidant activities of these substances. The concentrations of biophenolic compounds in olives are closely linked to texture and organoleptic characteristics of agrifood products, i.e. Table olive and olive oil. Very recently, considerable interest has arisen in the possible impact, exerted by the daily intake of functional foods, on several diseases, for their antioxidant biomolecular components. Modern pathological prevention has been linked to a number of natural phenolic biomolecules from fruits and vegetables, as associated to the Mediterranean diet. Due to their phenolic functionality, typical secondary plant metabolites constitute a distinctive group of phytochemicals, behaving as phytoprotectants. These possess great structural diversity and wide phylogenetic distribution (Bianco and Uccella, 2000). Black olives are a good source of monounsaturated fats. Monounsaturated fats help to lower LDL (the bad cholesterol) as well as protect against heart diseases. Monounsaturated fats along with polyunsaturated fats are considered to be "good" fats in terms of overall health. Black olives are a good source of vitamin E, a strong antioxidant vitamin that helps to protect cells against free radical damage. One cup of olives supplies almost a quarter of the day's requirement for vitamin E. It also protects against oxidation of cholesterol which can damage blood vessels, leading to an increased risk of heart attack. Black olives are a good source of polyphenols, antioxidants that may reduce the risk of heart disease and cancer.

Mushrooms

Agaricus bisporus, commonly known as white button mushroom, constitutes the bulk of the total mushrooms consumed in most Western countries and considered as a nutritional ingredient of pizza. Edible mushrooms and their constitutive active compounds have been described to have beneficial effects on hyperglycemia, hypercholesterolemia and cancer (Bobek and Galbavy, 1999). Mushrooms are quite high in protein (19-35 percent, including all the essential amino acids) and low in fat. Mushrooms also contain relatively large amounts of carbohydrate and fibre, ranging from 51 to 88 percent and from 4-20 percent (dry weight), respectively, for the major cultivated species. *Agaricus bisporus* contains high levels of dietary fibres and antioxidants including vitamin C, D, and B_{12}; folates; and polyphenols that may provide beneficial effects on cardiovascular and diabetic diseases (Jeong *et al.*, 2010). Vitamin D_2 contents are considerable in many wild mushroom species. For example, according to Mattila *et al.* (1995), *Chantarellus tubaeformis* contained vitamin D_2 at a concentration of 29.8 mg/100 g fresh weight. As compared to the recommended daily intake for adults (5 mg/day), eating 100 g of these mushrooms would fulfil nearly one week vitamin D requirement. *C. cibarius* was also found to contain high concentrations of vitamin D_2 (12.8 mg/100 g), whereas other wild mushrooms studied contained

2.9-5.8 mg/100 g. Unfortunately, only trace amounts of vitamin D_2 were found in the most popular cultivated mushroom, *A. bisporus*. Mushrooms cultivated indoors contain lower levels of vitamin D_2 than those cultivated outdoors because the metabolic route from ergosterol to ergocalciferol (vitamin D_2) requires sunlight or artificial ultraviolet (UV) light. These functional characteristics are mainly due to the presence of dietary fibres and in, particular, chitin (Manzi *et al.*, 1999), a structural polysaccharide of cellular walls, and beta glucans (Manzi and Pizzoferrato, 2000; Mullins, 1990), homo- and hetero-glucans with β (1-3), β (1-4) and β (1-6) glucosidic linkages.

The medicinal property for which mushrooms have been most extensively investigated is their antitumor activity. Most of this research has been conducted in Japan. Whole mushrooms of several species and/or extracts from them have been reported to have an antitumor effect: Among these species are *A. bisporus, Auricularia auricula,Collybia confluens, Coriolus versicolor, Flammulina velutipes, Ganoderma applanatum, G. lucidum, L. edodes, Pholiota nameko, Pleutorus ostreatus, Schizophyllum commune, Tremella fuciformis, Tricholoma matsutake,* and *Volvariella volvacea* (Johl *et al.*, 1995-96; Breene, 1990). Ikekawa *et al.* (1969) found that intraperitoneal injection of aqueous extracts of six of seven edible mushrooms species tested greatly inhibited the growth of tumours (by 72-92 percent versus controls) arising from sarcoma-180 cells implanted in Swiss albino mice. Based on chemical analysis the active antitumor agent in shiitake was suggested to be a polysaccharide. It was later called lentinan and its chemical structure was characterized as β-1,3 glucan, having branching of the 1,6 bonds. In addition, lentinan was proven to exhibit prominent antitumor activity not only in allogeneic hosts but also in syngeneic and autochthonous hosts with no noticeable side effects. Furthermore, it can prevent chemical and viral carcinogenesis and cancer metastases. Its effect results from the activation of the host's immune system (Chihara, 1993, 1992).

Conclusion

In the past it was commonly believed that pizza was not really a healthy food. Part of the reason for this is that it was put in the same group as other fast foods, such as hamburgers and fries. This is a major misconception, as pizza can actually be a highly nutritional meal. Recent research on the nutritional aspects of the pizza showed that the production of pizza has to be increased, as in the past years; preference and acceptability for consumption of pizzas have increased. With the many health benefits of pizza, it can no longer be viewed in the same light as other fast foods.

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