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Processing Technology, Chemical Composition, Microbial Quality and Health Benefits of Dried Fruits

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Abstract

Fresh fruits have high moisture content and deteriorate quickly if not handled properly. Use of storage technologies like refrigeration and controlled atmospheres are very much expensive because of continuous energy requirement throughout the whole supply chain. So, drying of fruits is being utilized to minimize the postharvest losses and provide an ease in storage, transport, and availability through out the year. Fruits in dried form reperesent concentrated form of important nutrients and serve as valuable healthy foods. The routine consumption of dried fruits is advised to achieve the full advantage of their inherent vital nutrients and other bioactive compounds. Fruits are dried by various drying techniques including conventional (solar drying, shade drying) and novel (microwave, infrared, freeze and hybrid drying) drying methods , etc. Drying of fruits using conventional metods such as sun or open-air drying is time consuming and may lead to the inferior quality along with microbial contamination. Numerous studies have revealed that dried fruits may contain food-borne pathogens including bacteria, yeasts and moulds, which can be responsible for the outbreak of life-threatening diseases. In this review, the drying of fresh fruits by different drying methods, their chemical composition, microbial quality, and health benefits has been discussed.

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Introduction

Fresh fruits contain of more than 80% moisture and are regarded as highly perishable food commodities. Fresh fruits deteriorate more rapidly, and it is projected that about 30% to 50% losses have been reported in fruits from the farm gate to consumer's level. These loses could cause a high food insecurity in the world's population. Postharvest techniques like drying can be employed to reduce these losses.[1] Drying is the most common and the oldest technique

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for preserving quality and increasing the shelf life of fruits so as to make the product available throughout the year and not just at harvest time. Dried fruits stand out as convenient foods that fit many needs of a healthy and modern lifestyle.[2] Water from fruits can be removed either naturally through sun drying or by using various types of dehydrators or driers. Dried fruits have lower moisture content than fresh fruits and represent a concentrated form of nutrients.[3] Dried fruits regarded as beneficial and healthy snacks are recommended to be consumed daily because of various health-promoting essential nutrients, antioxidants, and phytochemicals.[4] Although dried fruits tend to be expensive, the cost becomes reasonable when the health and nutrition benefits of dried fruits are taken into consideration. Dried fruits also act as a convenient food as the dehydration process for fresh fruit results in smaller size and less weight, making dried fruits an ideal choice when travelling by air.[1] In recent years, the benefits of dried fruits have gained much more attention as a healthy alternative to traditional snacks that have high fat and processed sugar content.[5] Both conventional (sun drying; shade drying) and novel methods (microwave drying, freeze drying, hybrid drying) are employed in drying of fruits. Conventional methods are slow and may lead to the inferior quality product while the advanced drying techniques require less time and retain the fruit quality[1]. Although dried fruits heve reduced water activity which reduces the chances of microbial growth but fruits dried in open or under unhygienic conditions have micobes associated with them which may cause diseases in consumers when consumed.[6] The present review will focus on the process technology for dried fruits, their chemical composition, microbiological quality, and health benefits.

Fig. 1: Fruits dried by various drying methods

Drying of Fruits

Drying is the oldest method of preserving food which reduces the water activity of the food. Yeasts, molds, and bacteria are not able to grow below water activity levels of 0.87, 0.88, and 0.90, respectively. Consequently, by a decline in water activity by drying, microorganisms are not able to grow.[7] Drying not only prevents the growth of microorganisms but also inhibits the other moisture-driven reactions that cause deterioration and thus maintain the nutritional value and other quality attributes of the original product[8] Drying of the fresh fruit can be done as whole fruit (e.g., grapes, apricots, berries), in slices (e.g., kiwis, papayas and mangoes) or halves (apricot, peach and plum) .[9] The drying or dehydration process includes simultaneous heat and mass transfer to remove moisture.[10] The removal of unbound or free water is termed as drying, whereas the removal of moisture content to reach up to 2 to 5% of the initial weight of the product is referred to as dehydration.[11] To prevent browning during drying fruits are given special treatments before drying. Commonly fruits are treat with Sulphur dioxide to prevent the browning and to maintain the nutritional status.

Methods For Fruit Drying

Traditional drying methods

Shade Drying

In the shade drying method, the fruit is first washed properly and then spread onto trays (mesh trays) which are then enclosed in a room and left to completely dry in the shade. The temperature used in this method is approximately (20-30) ℃.[12] The time taken to dry the produce by the shade drying is longer than that for solar drying method and is a time consuming process. The shade drying method provides an advantage over sun drying i.e., to prevent the light-sensitive compounds from degradation, and photochemical reactions such as oxidation.[13]

Solar/Sun Drying

This is one of the oldest and most traditional methods for drying a material, utilizing solar energy to directly heat the material. In the sun drying, the product is first spread onto trays or any clean surface and is left to dry up to the level of desired moisture content. During the drying process, the fruit pieces are evenly exposed to solar radiation from all sides by consistent turning which is important to completely dry the material from all sides and increases the drying efficiency.[14,15,16] However, the sun drying method increases the chances of contamination by microorganisms and, is also a time-consuming process.[8]

Osmotic Dehydration

In this process removal of unbound moisture from the material is achieved by immersing it in a solution of higher concentration (hypertonic solution). Materials used in the preparation of these solutions should have high solubility, for example, sugars and common salt used for fruits and vegetables, respectively.[17] Transfer of solutes and water between the product and the solution is by immersing the product in the processing tank. Speed of diffusion may be enhanced by utilizing electrical field pulses of high-intensity, pressure variations, and various other pretreatments (freezing, supercritical carbon dioxide treatment and blanching).[18,1] Post-treatment is required for shelf life enhancement of the product that has been dried by osmotic dehydration.

Modern Drying Methods for Fruits

Freeze Drying

Freeze-drying includes the process of drying in which the product in frozen state is dried under high vacuu.[19] In freeze-drying, the product is first frozen and then reducing the surrounding pressure so that the frozen water in the fruit sublimes directly from solid to gas phase i.e., from ice to vapor. The physical properties of freeze-dried fruits are different from those of heat-dried fruits. In freeze drying fruits retain most of the color, nutritients, and shape, thus the quality of the final product is maintained. Moreover, in freeze-dried samples, the loss of bioactive components viz. flavonoids, flavanol's, phenolics and catechins is found to be insignificant.[20] The retention of vitamins and other nutrients in freeze-dried products is also greater than that for heat dried products because freeze-drying involves lower drying temperatures.

Vacuum Drying

In this method, the air is replaced by a vacuum so that moisture can be removed from the product. The vacuum employed reduces the saturation vapor pressure at a given temperature, and the water vaporss are removed from the drying vessel. Thus, in vacuum drying, the material is dried at a lower temperature. Conduction or radiation type of heat transfer occurs in vacuum drying.[22] Vacuum drying carried out under low-pressure conditions ensures a more fruitful effect on the food material being dried as low drying temperatures are employed.[20]

Tunnel Drying

Tunnel drying is a type of continuous drying process. The trays in the tunnel dryer pass through an insulated tunnel on trolleys where heat is supplied, and vapors are removed constantly. This method of drying is an improvement over the cabinet-and-tray dryer. Due to various advantages, tunnel dryers are largely used on an industrial scale. Tunnel drying is mostly used to dry figs, apricots, peaches, dates, apples, pears, and many more in the form of liquids, pieces, and purees.[22]

Microwave Drying

In this type of drying, electrical energy is used (frequency -300 MHz to 300 GHz), with the most common frequency being is 2,450 MHz. Microwaves are generated inside an oven by a magnetron which converts electrical energy into an oscillating electromagnetic field[23] Microwave heating only requires moderately low energy consumption because of reduced processing time and volumetric heating. This method of drying is typically combined with forced air or vacuum to improve the efficiency of the microwave process as microwaves alone can't be able to dry the product completely.[24]

Tray Drying

Tray drying is a simple method of drying that can dry products at a high volume. In this type of drying, the product is put on trays and then kept in a drying chamber. With tray drying, forced convection heating is used for the removal of moisture from the product. Tray drier is used to dry fruits such as raisins, prunes, apricots etc. Tray drying is successful because of the uniform distribution of the air over the trays.[25]

Hybrid Drying

Conventional drying techniques utilized for the drying of fruits have been used extensively over the years both commercially and industrially. However, most of the conventional techniques showed a determinant impact on various quality attributes of the final product and consume significant time and energy. As a result, interest in hybrid drying techniques has been gaining interest to minimize the effect of drying on product quality.[26] The hybrid drying technique uses multiple modes of heat transfer and involves two or more stages of drying to attain the desired dryness. Feng *et al.,* (1999)[27] examined that the hybrid drying techniques are more beneficial to improve the quality of the product and decrease the chances of degradation of the product. Many combinations for instance using microwave drying with fluidized bed drying was tested and this increases the uniformity of drying.[28] Some of the advantages and disadvantages of drying methods that are used in the drying of fruits are presented in Table 1.

Table 1: Drying Methods Utilized for Drying of Fresh Fruits

Method of drying	Fruit studied	Advantages	Disadvantages	References
Shade drying	Raisins, Pear	Reduces light-ind uced chemical rea -ctions and preser -ves substances that are light-sensitive. Inexpensive	Excessively long pro cess time and the quality of the product is not good	67, 68,
Sun or solar drying	Raisins, Apple Figs, Apricot pear	Large capacity and Inexpensive	Long drying times, Poor product quality (excessive browning and casehardening) Unhygienic.	67, 69, 70
Osmotic dehydration	Apple, Papaya Kiwi, Apricot,	Retention of volatile components and	Alters the taste of the product,	71,72, 73, 74

	Figs	improved texture	the osmotic solution gets wasted and leaching out of color, acids, sugars, minerals, vitamins.	
Freeze drying	Strawberries	Best quality product with retention of maximum heat sensitive compon -ents; High porosity and rehydration capacity of products.	Very long dying drying times and Uneconomical.	75
Vacuum drying	Banana	Rate of drying is high, lower process temperature, rehyd -ration ratio is high and shrinkage of the product is high	Time-consuming and high pressure can cause the darkening of the product.	76
Tunnel drying	pears	The air that is circulated has controlled humidity and temperature. Most flexible and efficient drying system	High heat consum 0ption. Oxidation of food components.	77
Microwave drying	Grapes Apricots	Fast volumetric heating. Higher and drying rate; Enhan -ced qualityof the product	Partial loss of aroma negative sensory changes; Specific sample size and shape may be required for effective drying.	78, 79
Tray drying	Prunes Apples Raisins Apricots	Recovery of the product is efficient; Low operating cost; Thermal efficiency is high.	Non-uniform heating can take place due to the conduction mode of heating and central air distribution; Components that are temperature sens itive may get degraded.	25
Hybrid drying	Banana Raspberry Pear	Preserves and enhances quality attributes; Reduces energy consumption; Reduces time consumption; Increases overall efficiency of drying.	No specified process conditions for achieving the optimum result; Inadequate processing conditions; Complex equipment design and installation; High capital cost.	80, 81, 82

Nutritional Composition Of Dried Fruits

Dried fruits are regarded as important healthy snacks worldwide which nutritionally represent the concentrated form of fresh fruits in smaller serving sizes. Nutritional composition of various dried fruits is presented in Tables 2 and 3. The average percentage of moisture, fat, protein, carbohydrate, fibre and energy of various dried fruits varies from 15.43 to 31.8%, 0.27 to 1.09%, 0.17 to 4.08%, 61.33 to 82.82%, 3.7 to 9.8%, and 239 to 308 Kcal respectively (Table 1). The chemical composition of dried fruits contains a good amount of Ca, Fe, Mg, Na, K, Cu, β-carotene, α-carotene, Lutein-Zeaxanthin, vitamin A, and l phenols in the range of 9 to 162 mg, 0.39 to 4.06 mg, 4 to 68 mg, 2 to 87 mg, 49 to 1162 mg, 0.06 to 0.47 mg, 0 to 2163 µg, 0 to 57 µg, 0 to 559 µg, 0 to 3604 IU and 248 to 960mg respectively. [29,30]

Table 2: Proximate Composition of Dried Fruits

Type of Fruit	Moisture (%)	Fat (%)	Protein (%)	Carbohydrate (%)	Fibre (%)	Energy (Kcal)
Apples	31.76	0.32	0.93	65.89	8.7	243
Apricots	30.89	0.51	3.39	62.64	7.3	241
Currants	19.21	0.27	4.08	74.08	6.8	283
Cranberries	15.79	1.09	0.17	82.82	5.3	308
Dates	20.53	0.39	2.45	75.03	8.0	282
Figs	30.05	0.93	3.30	63.87	9.8	249
Peaches	31.80	0.76	3.61	61.33	8.2	239
Pears	26.69	0.63	1.87	69.70	7.5	262
Plums	30.92	0.38	2.18	63.88	7.1	240
Raisins	15.43	0.46	3.07	79.18	3.7	299

(Data is for traditional dried fruits which are defined as those with no added sugars, typically sun-dried or dried with minimal processing. Nutrient information is taken from the United States Department of Agriculture (USDA) Nutrient Database Standard Reference, Release 28 (USDA, 2017).[83]

Table 3: Minerals, Vitamin-A and Total phenolic content of dried fruits

Type of Fruit	Ca (mg)	Fe (mg)	Mg (mg)	Na (mg)	K (mg)	Cu (mg)	β-carot -ene,(µg)	α-carote -ne, (µg)	Lutein-Zeaxa nthin, (µg)	Vitamin A, (IU)	Total phen ols,(mg GAE)
Apples	14	1.40	16	87	450	0.19	0	0	0	0	324
Apricots	55	2.66	32	10	1162	0.34	2163	0	0	3604	248
Currants	86	3.26	41	8	892	0.47	43	1	0	73	NA
Cranberries	9	0.39	4	5	49	0.06	27	0	138	46	NA
Dates	39	1.02	43	2	656	0.21	6	0	75	10	661
Figs	162	2.03	68	10	680	0.29	6	0	32	10	960
Peaches	28	4.06	42	7	996	0.36	1074	3	559	2163	283
Pears	34	2.10	33	6	533	0.37	2	0	50	3	679
Plums	43	0.93	41	2	732	0.28	394	57	0	781	938
Raisins	50	1.88	32	11	749	0.32	0	0	0	0	106

GAE, gallic acid equivalents; IU, international unit; NA, not available.[84]

Microbial Quality Of Dried Fruits

Food safety is a public health priority and is a global issue. Dried fruits/fruit products are typically consumed without any additional processing technique such as cooking or any other thermal treatment that kills or reduces the number of microorganisms. Moreover, drying of fruits in open or under unhygienic conditions may be prone to microbial contamination. So, consumption of these dried fruit results in increased chances of various health problems, some of which can be life-threatening.[31] Different types of microorganisms such as *salmonella, shigella,* coliforms, *Eischerchia coli*, fungi and yeast. can be present in dried fruits. These microbes can cause various diseases such as typhoid fever, diarrhoea, cholera, and many other health issues.. From previous studies, in home-dried food samples, the disease-causing microorganisms such as *Shigella, Salmonella, Bacillus* and other *Enterobacteriaceae* were detected. Home-dried food samples were found to be contaminated with 55% of the faecal coliforms. It was found that above 60% of samples were contaminated with higher than acceptable microbial levels.[32] Dried fruits are also likely to be contaminated by mold growth contamination and mycotoxin production. Mold growth in food products can occur either before or after harvest and during storage when warm, damp, and humid conditions exist. Several hundred different mycotoxins have been identified in dried fruits, and the important species of microbes producing mycotoxins are *Aspergillus, Penicillium and fusarium.* Dried fruits can be contaminated by fungi as some fungi can easily grow under conditions of low water activity. To predict the risk of mycotoxin contamination in dried fruits, knowledge of the occurrence of fungi is necessary.[33] Although, drying or dehydration is a process that lowers the microbial count of dried fruits, the extent of reduction in microbial flora depends upon the type of the fruit and the severity of the treatment. Drying figs at a low temperature of (54-60)˚C reduces the growth of yeast, but it does not eliminate the yeast count from figs.[34] In contrast, if prunes are dried at a temperature of (70-80)˚C, commercial sterility can be achieved.[35] However, prunes can later become re-contaminated due to improper handling.[36] Studies regarding the microbial quality of various dried fruits are presented in Table 4.

Table 4: Microbial Quality of Some Dried Fruits

Type of fruit	Microbial flora	Microbial count	References
Dried figs	Bacteria, yeasts, and molds	Bacteria (3.64×10^5 cfu/g), yeast (1.00×10^3 cfu/g) and mold (0.97×10^3 cfu/g)	85
Dried figs, apricots, raisins, and plums	Aerobic mesophilic bacteria (AMB), molds, yeasts, and spore-forming bacteria	AMB ($(4.4\pm1.8) \times 10^2$~ $(9.6\pm6.3) \times 10^3$ cfu/g Molds $(4.7\pm2.4) \times 10^3$~$(6.3\pm2.3)\times10^4$ cfu/g Yeasts $(2.5\pm0.84)\times10^2$~ $(7.8\pm2.8)\times10^2$ cfu/g	86
Dried dates	Bacteria (species of Strepto -coccus, Staphylococcus aur -eus, Enterobacter species, Escherichia coli, Salmonella species, Proteus mirabilis,), coliform, molds and yeasts	Bacteria (4×10^5 – 19×10^5 and 10×10^5 – 20×10^5) Coliforms (3-9 and 11-3) Molds (1.0×10^2 – 2.8×10^2 and 4.8 x 103- 7.2 x 103) Yeasts (1.6×10^2 – 8.2×10^3 and 5×10^4- 16×10^4)	87
Dried figs	Mycotoxins (aflatoxins, -kojic acid, and patulin)	Aflatoxins (Above 4 µg/kg), kojic acid (8600 µg/kg) patulin (152 µg/kg)	88, 89
Dried dates	Aerobic bacteria, yeasts and molds	Aerobic bacteria (3.30-5.65 log cfu/gm) Yeasts and molds (3.30-5.36 log cfu/gm)	90

Raisins, Strawberries	Aerobic count, yeast and mold count	Aerobic count (2.18 to 2.90 log cfu/g) yeast and mold count (2.33 and 3.07 log cfu/g)	91
Dried apricot	Mesophilic aerobic bacteria, Psychrophilic aerobic bacteria, lactic acid bacteria, yeast, and mould, xerophilic mould, Staphylococcus species and Enterobacteriaceae	8.20×101 to 1.84× 102 cfu/g Less than 4 cfu/g	92

Common microbes occurring in dried fruits

Salmonella

Salmonella is a pathogenic bacterium that causes salmonellosis. Most of the salmonella-related illnesses are a result of the contamination of low moisture food products. Salmonella shows its prevalence in raw ingredients and can survive under dry and harsh conditions for prolonged periods.[37,38] Salmonella infection causes food poisoning, gastroenteritis, enteric fever, and other illnesses. If the salmonella infection is kept untreated it can lead to bacteremia, a stern condition in which microbe passes through the intestinal barrier into the bloodstream. Bacteremia caused by salmonella should always be considered as a possibility in cases where the cause of fever is unknown. Antibiotics should be given to patients suffering from bacteremia.[39,40]

Shigella

Shigella is a pathogen that causes an infection known as shigellosis that is transmitted through the consumption of food or water that has been contaminated by faecal matter, and ingestion of just 10–100 organisms can result in disease.[41] Watery diarrhoea, dysentery, and complications such as encephalopathy are common symptoms of shigellosis. *Shigella* bacteria pass through the stomach and then cause tissue destruction by multiplying in the human intestinal tract.[42] The bacteria then spread into the large intestine (colon) causing cramps in that part of the body along with diarrhoea. A highly destructive and potent toxin called Shiga is produced by strains of shigella.[43] To suppress inflammation and the natural immune response, shigella produces effectors that promote infection and reduce the adaptive immune response, allowing the host to become prone to re-infection.[44]

Moulds

In most dried fruits including dried figs, prunes, and raisins, mold growth during production, or storage, thereby increasing the risk of mycotoxin contamination. The most frequently isolated mycotoxins from dried fruits are aflatoxins and ochratoxin A. Mycotoxins have various toxicological effects, and maximum mycotoxin levels have been set in foods and feed to protect animal and public health. During storage and processing, or when cooked at elevated temperatures, most mycotoxins are chemically stable and can thus survive high temperatures during cooking as well as storage conditions.[45] Mycotoxin contamination in dried fruits not only cause serious health risks but also extensive economic losses.[46]

Escherichia coli

This type of bacteria normally lives in the human or animal intestines. Although various strains of *E.coli* are harmless and cause brief diarrhoea, few other strains can cause severe symptoms such as abdominal cramps, urinary tract infections, blooded diarrhoea and vomiting. *E.coli* bacteria include commensal strains as well as pathogenic strains that result in the death of more than 2 million individuals each year.[47]

Health Benefits of Dried Fruits

Dried fruits such as prunes, apricots, raisins and figs are an important source of different phenolic compounds which act as antioxidants and can inhibit the harmful effects of the free radicals. They receive increasing attention for their potential role in the prevention of human diseases. Dried fruits are extremely nutritious and are excellent and healthy substitutes for daily snacks. Previous studies regarding essential components

Table 5: Essential Components and Health benefits of Some Dried Fruits

Type of Fruit	Essential Component	Health Benefits	References
Apricot	Polyphenols, carotenoids, flavo -noids, minerals, and vitamins.	Antioxidant activity, anti-inflamm -atory, anti-ageing, anti-carcinogenic.	52
Figs	Phenolic compounds, Minerals (Mg, Ca), Flavanols, Anthocyanins.	Anti-diabetic, antioxidant activity, anti-inflammatory, anti-ageing, anti-carcinogenic,	93, 53
Raisins	Minerals, polyphenols (mainly quercetin, kaempferol, caftaric acid, Flavanols, anthocyanins.	Antioxidant activity, anti-inflam -matory, anti-ageing, anti-carcinogenic.	51
Dates	Anthocyanins (cyanidin), Flavanol (quercetin), Tannins, polyphenols.	Antioxidant activity, anti-inflam -matory, anti-ageing anti-carcinogenic.	94
Kiwi	Vitamins, minerals polyphenols, flavonoids carotenoids.	Cytotoxic and antioxidant activity, anti-inflammatory, anti-carcinogenic, anti -depressant, anti-diabetic	95, 96

and health benefits of various dried fruits are presented in Table 5. One serving of dried fruits can provide a large percentage of many vitamins and minerals. However, the vitamin C content is reduced when the fruit is dried.[48] Dried fruits are rich in fibre and act as a reservoir of antioxidants, especially polyphenols.[49] Antioxidants aid in better digestive health, improved blood flow, decrease oxidative damage and help to reduce the risk of many diseases. Polyphenols also exhibit antioxidant, anti-ageing, anti-inflammatory, and anti-carcinogenic properties and enhance endothelial function.[50] Polyphenols such as kaempferol, caffeic acid, quercetin and coumaric acid are abundantly present in raisins[51] Apricots are rich in iron, magnesium, zinc, calcium, potassium, and phosphorus and also contain significant amounts of thiamine, vitamin A, vitamin C, pantothenic acid, niacin, and riboflavin.[52] The most abundant minerals in apricots are iron and potassium. Dried figs are rich sources of calcium and magnesium whereas dried apricots contain an appreciable amount of iron.[53] Figs have higher phenolic content than red wine and tea.[54] Dried fruits such as apricots are also rich in beta-carotene and fiber. The nutrients in apricots help to fight diseases Apricots are an important heart-health food high in beta-carotene content. In addition, apricots contain vitamin A which is essential for maintaining good vision.[55] It has been reported that consuming 40g of dried fruits on a per-serving basis provides 3.3 -9.9% of potassium and more than 90% of the dietary fibre for recommended daily allowances for adults.[56] Consuming enough potassium results in a reduction in blood pressure.[57] A higher intake of dietary fiber dried fruits reduces the risk of various non-communicable diseases such as obesity, type 2 diabetes, colorectal cancer, and diverticulitis.[58] Dried fruits also contain moderate quantities of magnesium which has positive effects on glycemic control.[59] Minerals such as magnesium that are present in dried fruits lower the risk of developing type 2 diabetes and other chronic diseases.[60,61] Researchers have concluded that consuming dried fruits could be a beneficial way to boost the intake of vital nutrients. The frequent consumption of dried fruits averts and controls metabolic conditions such as type 2 diabetes (T2D), heart-related diseases and metabolic syndrome.[62] Mills, Beeson, Phillips, and Fraser (1989)[63] reported anticancer effects of dried fruits prostate. They found that increased consumption of raisins, dates, and other dried fruits significantly reduced the risk of prostate cancer. An in vivo study revealed that Dried peach supplementation of a cholesterol-containing diet significantly prevented the rise in plasma and liver lipids.[64] Consumption of dried cranberries was effective in minimizing reoccurrence and severity of urinary tract infections.[65] Consumption of raisins showed antidiabetic effect with improved glycemic and insulin response in diabetic patients.[66]

Conclusions

Dried fruits stand out as convenient food that fit many needs of a healthy and modern lifestyle. They have a peculiar combination of aroma, taste, vital nutrients, and phytochemicals. They provide great nourishment and health benefits. Drying methods being used for drying of fruits differ in efficacy and impact on the quality of dried fruits. Despite being a good source of nutrients, dried fruits may which associated with various microbes, some of which may be pathogenic. Treatments including ozonation, cold plasma, microvave sterlisation, and ultraviolet (UV-C) treatment cold be applied for decontamination of dried fruits. More research should be carried out to determine their health benefits, microbial safety, and their decontamination. There are substantial opportunities in development of dried fruits and dried fruit based functional food products for the expansion of their market.

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Conflict of Interest

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