JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

A COMPRATIVE STUDY FOR HEALTH BENEFITS FROM DRY FRUITS AS A DIETRY SUPPLIMENTS

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Abstract

Phytochemicals are non-nutritive, naturally occurring, and bio- logically active compounds found in the plant kingdom. Non-specific methods such as determination of total phenolics and anthocyanins by pH differential and specific methods such as high performance liquid chromatography. They are nutritionally equivalent to fresh fruits in smaller serving sizes, ranging from 30 to 43 g depending on the fruit, in current dietary recommendation in different countries. Recently, much interest in the health benefits of dried fruits has led to many *in vitro* and *in vivo* (animal and human intervention) studies as well as the identification and quantification of various groups of phytochemicals. This review discusses phytochemical compositions, antioxidant efficacies, and potential health benefits of eight traditional dried fruits such as apples, apricots, dates, figs, peaches, pears, prunes, and raisins, together with dried cranberries. Fruits constitute a major part of the human diet.

KEYWORDS: health, benefits, serving sizes, nutritionally equivalent.

INTRODUCTION

Nutrition plays a major role in the primary and secondary prevention of non-communicable diseases. Consumption of fruits and vegetables is one of the essential nutritional recommendations to prevent non-communicable diseases. The 2010 Dietary Guidelines for Americans also recommended to make one half of food plates with fruits and vegetables. Fruits constitute a major part of the human diet. Besides, fruits may be consumed as a part of religious practices and as nutritional therapy in different human traditions around the world.[(1)] Studies indicate that the role of fruits together with their nutrients in the prevention of non-communicable diseases could be stronger than vegetables[(2)]. Most of the common fruits are produced on a seasonal basis and hence may not be available in fresh conditions through- out the year. Thus, fresh fruits are processed by various techniques to become dried fruits to prolong their shelf life. Dried fruits are a concentrated form of fresh fruits, albeit with lower moisture content than that of their fresh counterparts since a large proportion of their moisture content has been removed through sun-drying or various modern drying techniques[(3)]. Fruits can be dried whole (e.g., grapes, berries, apricots, and plums), in halves, or as slices (e.g., mangoes, papayas, and kiwis) [(4)].

Dried fruits are important healthy snacks worldwide. They also have the advantage of being easy to store and distribute, available throughout the year, and healthier alternative to salty or sugary snacks. Apples, apricots, dates, figs, peaches, pears, prunes, and raisins are referred to as ''conventional'' or ''traditional'' dried fruits[(5)].

Although raisins, figs, dates, prunes, and apricots are the most common dried fruits in the marketplace, food stores and local markets offer many more choices such as dried apples, pineapples, berries, mangoes, and papayas, among others.[(6)] They are rich sources of essential nutrients and health-promoting bioactive compounds. Epidemiological evidence have demonstrated an association between dried fruit consumption and diet quality[(6)]. Raisins are the most studied among all dried fruits, followed by dates, prunes, figs, apricots, peaches, apples, pears, and other fruits.[(7)]

PHYTOCHEMICALS POTENTIAL OF DRIED FRUITS

Phytochemicals are non-nutritive, naturally occurring, and bio- logically active compounds found in the plant kingdom. Non-specific methods such as determination of total phenolics and anthocyanins by pH differential, and specific methods such as high performance liquid chromatography (HPLC), ultraviolet-visible spectroscopy (UV-VIS), and mass spectrometry (MS) have been used to characterise phytochemicals in dried.(8) Dried fruits provide a wide range of phytochemicals, such as phenolic acids, flavonoids, phytoestrogens, and carotenoids.(8)

PHENOLICS COMPOUNDS

Raisins contained the highest amount of phenolic compound (2414 mg AAE/100 g), followed by dried apricots, cranberries, peaches, figs, pears, and prunes. In another study phenolic compound [expressed as mg of gallic acid equivalents (GAE)/g] of dried fruits decreased in the order of prunes > raisins > figs > dates. However, in another study(9) dates demonstrated the highest phenolic compound [1959 mg cat- echin equivalents (CE)/100 g fresh weight (FW)], while figs had the lowest TPC (320 mg CE/100 g FW) among six dried fruits (apricots, cranberries, dates, figs, plums, and raisins) studied.(10)

FLAVONOIDS COMPOUNDS

The major flavonoids reported in dried fruits are antho- cyanidins, dihydrochalcones, flavonols, flavones, and flavan- 3-ols. Apricots contain all the above-mentioned classes of flavonoids.(11) The chemical structures of the representative flavonoids reported in dried fruits. Dried fruits contain undetectable amounts of anthocyanins, which are likely degraded to phenolic acids. Dates contain one anthocyanidin (cyanidin) and one flavonol (quercetin). No anthocyanins have been detected in dried pears and raisins(12). However, a number of anthocyanin (delphinidin-3-glucoside, cyanidin-3-glucoside, petunidin- 3-glucoside, pelargonidin-3-glucoside, peonidin-3-glucoside, and malvidin-3-glucoside) and anthocyanin-derived compounds (vitisin A, acetylvitisin A, B-type vitisin of malvidin-3-glucoside, peonidin-3-glucoside, peonidin-3-acetylglucoside, A-type vitisin of malvidin-3-acetylglucoside, and malvidin-3-acetylglucoside) have been detected in raisins from Spanish *Merlot* and *Syrah* varieties.(13)

Table 1 – Phytochemicals content present in dried fruits

Dried fruit	Total phenolics	Flavonoids	Flavonols	Phytoestrogens	Isoflavones	Total lignans[c]	Carotenoids[c]
Apples Apricots Cranberries Dates Figs Peaches Pears Prunes Raisins	916 2256 1819 661[e] 1234 1260 1196 1032 2414	-- 56.8[f] 7.66 2.63 105[f] ---- 2.58 0.85	-- -- 4.50 0.93 -- -- -- 1.80 0.26	-- 445 -- 330 -- -- -- 184 30.2	-- 39.8 -- 5.1 -- -- -- 4.2 8.1	-- 401 -- 324 -- -- -- 178 22.0	-- 2.2 -- 0.97 0.032 2.08 -- 0.69 nd

PHYTOESTROGENS

Dietary phytoestrogens present in dried fruits have attracted much interest due to their potential protective effects against various disease conditions such as cancer, cardiovascular disease (CVD), osteoporosis, and menopausal symptoms [(13)]. Some dried fruits, such as apricots, currants, dates, prunes, and raisins, contain phytoestrogens e.g., isoflavones (formononetin, daidzein, genistein, and glycitein), lignans (e.g., matairesinol, lariresinol, pinoresinol, and secoisolariciresinol), and coumestan (coumestrol) [(14)].

Apricots contain the highest amount of phytoestrogens (445 µg/100 g) among dried fruits, followed by dates (330 µg/ 100 g), prunes (184 µg/100 g), and raisins (30.2 µg/100 g)[(14)]. Dried fruits contain a higher concentration of lignans (ranging from 22.0 to 401 µg/100 g) than isoflavones (ranging from 4.2 to 39.8 µg/100 g) (Table 1). Coumestan, expressed as coumestrol, is generally present in low amounts in dried fruits. [(15)]

CAROTENOIDS

The low level of carotenoids in dried fruits may be due to the drying process since carotenoids are sensitive to heat. Nutrient Da- tabase reported that drying significantly increased carotenoids concentration (β-carotene, β-cryptoxanthin, and lutein) in dried peaches compared to its fresh counterpart.This happens because of the removal of water that concentrates the phytochemicals.[(16)]

Five carotenoids, namely, α-carotene, β-carotene, β-cryptoxanthin, lutein, and zeaxanthin, have been reported in some dried fruits. Of these, β-carotene, which acts as pro-vitamin A, is most abundant in dried apricots (2163 µg/100 g), followed by peaches (1074 µg/100 g), and prunes (394 µg/ 100 g).[17] Lutein + zeaxanthin (559 µg/100 g) and β-cryptoxanthin (444 µg/100 g) are detected only in dried peaches. Dates are the third richest source of carotenoids after dried apricots and peaches [18]Dates can be considered a moderate source of carotenoids. No carotenoids have been reported in raisins, while small or trace amounts of carotenoids have been found in dried apples, figs, pears, and prunes[19]

DRIED FRUITS AS A SOURCE OF ANTIOXIDANTS

Raisins (golden seedless) have the highest ORAC value [10,450 µmol trolox equivalents (TE)/ 100 g], followed by dried pears, prunes, apples, peaches, figs, and apricots. A number of methods have been used to determine the anti- oxidant activity of selected dried fruits.[20] These include ferric reducing antioxidant power (FRAP), oxygen radical absor-bance capacity (ORAC), 2,2′-azino-bis(3-ethylbenzothiazoline- 6-sulphonic acid) (ABTS), cupric ion reducing antioxidant capacity (CUPRAC), and 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity. Interestingly, dates have the lowest ORAC (2387 µmol TE/100 g) and TPC (661 mg GAE/100 g) among nine tested dried fruits.[20] Dried fruits were highly correlated with DPPH radical- scavenging. The total antioxidant activity (using three different *in vitro* assays) of some dried fruits (apricots, figs, prunes, and raisins) in which prunes had the highest value followed by apricots.[21]

Table 2 – shows that Antioxidant activities of from dried fruits.

Dried fruit	DPPH (mg AAE/100 g DW)	ORAC (μmol TE/100 g)	TAC (μmol TE/g)	L-ORAC$_{FL}$ (μmol TE/g)	H-ORAC$_{FL}$ (μmol TE/g)	FRAP (mmol Fe^{2+}E/kg)
Apples	875	6681	--	--	--	--
Apricots	3846	3234	--	--	--	36.64
Cranberries	3079	--	--	--	--	--
Dates	--	2387	23.87	0.27	23.6	--
Figs	1087	3383	33.83	1.83	32.0	14.43
Peaches	1442	4222	67.6[f]	--	--	--
Pears	1301	9496	--	--	--	--
Prunes	3112	8578	85.78	1.79	83.99	60.54
Raisins	1346	10450[e]	30.37	0.35	30.02	23.26

AAE, ascorbic acid equivalents; DPPH, 2,2-diphenyl-1-picrylhydrazyl; DW, dry weight; Fe^{2+}E, Fe^{2+}equivalents; FRAP, ferric-reducing antioxidant power; H-ORAC$_{FL}$, hydrophilic-oxygen radical absorbance capacity; L-ORAC$_{FL}$, lipophilic-oxygen radical absorbance capacity; --, not reported; ORAC, oxygen radical absorbance capacity; TAC, total antioxidant capacity; TE, trolox equivalents.

The antioxidant activities were in the descending order of raisins > apricots > figs.[22] Antioxidants of dried figs have been reported to protect plasma lipoproteins from subsequent oxidation. In addition, these antioxidants increased the plasma antioxidant capacity up to 4 h after consumption, alleviating the oxidative stress induced after consumption of high fructose corn syrup in a carbonated soft drink.[23]

PHENOLIC COMPOUNDS AVAILABILITY IN DRIED FRUITS

On the other hand, lower bioavailability of rutin from dried figs after intestinal digestion was evident. Besides, an increase in the amounts of both cyanidin-3-glucoside and cyanidin-3-rutinoside of dried purple figs was observed after gastric digestion[24]. Especially about the bioaccessibility and bioavailability of antioxidant polyphenols from dried fruits. Some have evaluated the total antioxidant activity, total proanthocyanidins, and major phenolic compounds of Turkish dried fig varieties at different phases of simulated gastrointestinal (GI) tract digestion.[25] They found that dried figs rendered higher bioavailability of chlorogenic acid compared to fresh figs after intestinal digestion (IN fraction). This indicates an increase in the amount of polyphenols after the gastric phase of the *in vitro* digestion process. However, after the pancreatic digestion phase, these antioxidants were degraded by the alkaline pH, giving rise to a significant loss in antioxidant activity after *in vitro* digestion.[26] These results are consistent with a recent study on Turkish dried fig varieties demonstrating higher TPC, total flavonoids, and total anthocyanin contents. Diet quality was measured using the Healthy Eating Index 2005. In short, dried fruit consumption was associated with improved nutrient intakes (vitamins A, E, and K, magnesium, phosphorus, and po- tassium), a higher overall diet quality score, and lower body weight/adiposity measures.[27]

ANTICANCER EFFECT BY DRIED FRUITS

The potential anticancer effects of dried fruits were reported in a cohort study of diet, lifestyle, and prostate cancer risk of approximately 14,000 men. Moreover, the decreased risk of prostate cancer was not related to exposure to vegetarian lifestyle during childhood, suggesting the potential benefits of dried fruits in the prevention of prostate cancer.[28-30] They found that increased consumption of raisins, dates, and other dried fruits were significantly associated with decreased prostate cancer risk.

CONCLUSION

From this review study it can be concluded that Dried fruits are important for human health in providing great nourishment and health benefits. Dried fruits are nutritionally equivalent to fresh fruits in smaller serving sizes. They have unique combination of taste/aroma, essential nutrients, fibre, and phytochemicals. More research should be carried out to determine the complete profiles of phytochemicals, such as phenolic acids, flavonoids, phytoestrogens, and carotenoids of other dried fruits in relation to their antioxidant activities or other bioactivities. In future we will tried to promote their consumption as a daily dietary supplement.

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