

# Traditional Dried Fruits: Valuable Tools to Meet Dietary Recommendations for Fruit Intake

## PURPOSE

It is the position of this group that traditional dried fruits should be included together with fresh fruits in dietary recommendations for fruit and vegetable intake around the world. Epidemiological studies have shown a consistent relationship between a diet rich in fruit and vegetables and a lower risk for many chronic diseases including cancer, heart disease and stroke, obesity and type 2 diabetes. The strength of the association between fruit and vegetable consumption and health has led organizations around the world to recommend that populations increase their daily fruit and vegetable intake. Despite campaigns and educational efforts, a significant gap still remains between the recommended amount of fruits and vegetables and the quantities actually consumed by populations around the world. Traditional dried fruits provide essential nutrients, such as fiber and potassium, and an array of health protective bioactive compounds. They are devoid of fat, very low in sodium and have no added sugars. Because they are naturally resistant to spoilage, easy to store and transport, available year round, readily incorporated into other foods, and relatively low in cost, dried fruits represent an important means to increase overall consumption of fruit, to bridge the gap between recommended intake of fruits and the amount populations actually consume.

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## Traditional Dried Fruits: Valuable Tools to Meet Dietary Recommendations for Fruit Intake

***It is the position of this group that traditional dried fruits should be included together with fresh fruits in dietary recommendations for fruit and vegetable intake around the world.*** Epidemiological studies have shown a consistent relationship between a diet rich in fruit and vegetables and a lower risk for many chronic diseases including cancer,<sup>1 2 3</sup> heart disease<sup>4 5</sup> and stroke,<sup>6</sup> obesity and type 2 diabetes.<sup>7 8</sup> The strength of the association between fruit and vegetable consumption and health has led organizations around the world to recommend that populations increase their daily fruit and vegetable intake.<sup>9 10 11 12</sup> Despite campaigns and educational efforts, a significant gap still remains between the recommended amount of fruits and vegetables and the quantities actually consumed by populations around the world. Traditional dried fruits provide essential nutrients, such as fiber and the minerals potassium and calcium, and an array of health protective bioactive compounds. They are devoid of fat, very low in sodium and have no added sugars. Because they are naturally resistant to spoilage, easy to store and transport, low in carbon offset, available year round, readily incorporated into other foods, and relatively low in cost,<sup>13</sup> dried fruits represent an important means to increase overall consumption of fruit, to bridge the gap between recommended intake of fruits and the amount populations actually consume.

### I. Definition of Traditional Dried Fruits

The category of “traditional dried fruits” comprises those where a large portion of their original water content has been removed, either naturally through sun drying (e.g. raisins and figs) or through the use of specialized dryers or dehydrators (e.g. dried plums). It includes dried apricots, peaches and other dried tree fruits treated with sulfur dioxide before drying to inhibit browning. It also includes dates, which are considered to be dried fruits, even though most varieties are not dried but are “fresh” fruit with naturally low moisture content. Traditional dried fruits do not include dried fruits infused with sugar solutions or fruit juice concentrates (e.g. dried blueberries, cranberries or cherries), candied dried fruits (e.g. dried pineapples) or dehydrated fruits with very low moisture content.

Because traditional dried fruits are minimally processed, they retain most of the nutritional value of their fresh counterparts. At the same time nothing is added to the fruits that alters their nutritional value.

## **II. Scientific Support for Recommendations to Increase Intake of Fruits and Vegetables**

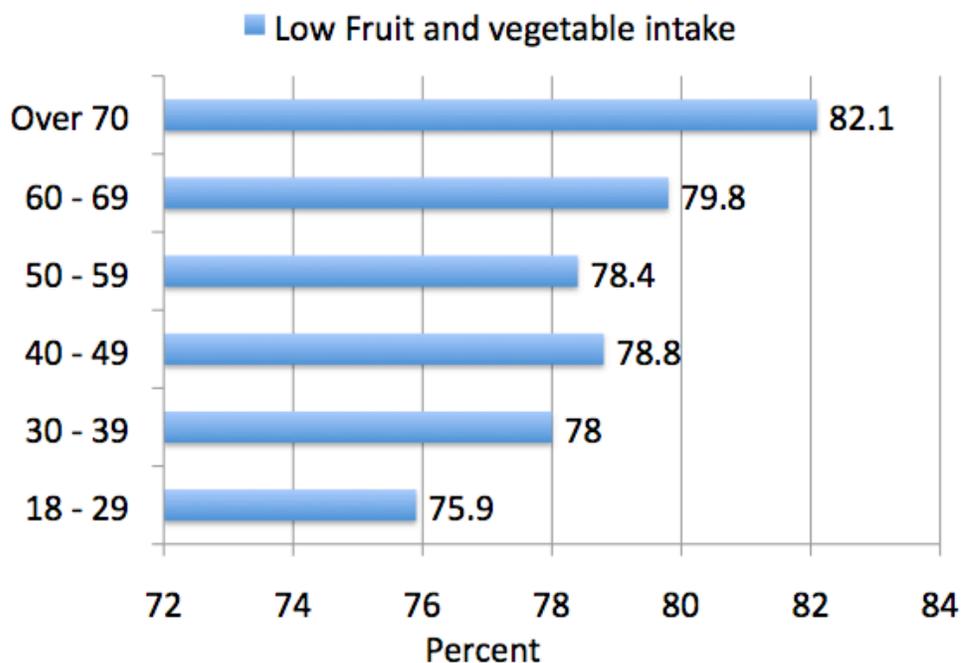
The rationale that supports recommendations for populations to eat more fruits and vegetables is three-fold: First, high fruit and vegetable intake is associated with a reduced risk of many chronic diseases. Second, most fruits and vegetables provide many essential nutrients, including potassium, dietary fiber, calcium, magnesium and vitamins A, C and K. Fruits are major sources of potassium, fiber, and vitamin C. Of these, fiber and potassium are of particular public health concern because world populations under consume them. Third, most fruits and vegetables are very low in sodium, when prepared without added fats or sugars, are relatively low in calories and the fiber/sugar ratio is high.

## **III. Fruit and Vegetable Intake and Chronic Disease**

The World Health Organization (WHO) estimated in 2000 that 2.7 million deaths (4.9%) and 26.7 million disability adjusted life years were attributable to low fruit and vegetable intake globally.<sup>14</sup> Further, 31% of ischemic heart disease, 20% esophageal cancer, 19% of ischemic stroke, 19% of gastric cancer and 12% of lung cancer globally could be prevented by increasing dietary intake of fruits and vegetables to the minimum recommended established by the WHO (400 grams of fruits and vegetables a day or the equivalent of five servings of 80 grams each).<sup>15</sup> Among European nations (EU-15), the estimated number of deaths that could be prevented range from 44,000 if fruit and vegetable intake were to reach 400 g per day and 121,000 if consumption were to reach 600 g per day.<sup>16</sup> Although low fruit and vegetable intake is only one of the many risk factors for cardiovascular disease and cancer, its impact is significant. For example, findings from the WHO Global Burden of Disease Study show that 28% of the burden of ischemic heart disease in developed regions of the world (including Europe, North America, Australia and Japan) could be attributed to a lack of fruit and vegetables in the diet.<sup>17</sup> This compares with 58% from high blood pressure, 63% from high cholesterol, 33% from overweight, 22% from physical inactivity, 22% from tobacco and 0.2% from alcohol intake. Using industry dry down ratios for fruit (fresh:

dried)<sup>i</sup> a serving of dried fruit would make a significant contribution towards meeting the weight recommendations for fruit and vegetable intake.

Figure 1. Prevalence of low fruit and vegetable consumption for men and women combined (pooled sample of 52 countries) by age strata<sup>1</sup>



<sup>1</sup> World Health Survey 2002 – 2003, Adapted from Hall JN, Moore S, Harper, SB and Lynch JW. Global variability in fruit and vegetable consumption. *Am J Preventive Med.* 2009; 36(5):402-409.

Despite these statistics a significant gap still remains between fruit and vegetable recommendations and the quantities populations actually consume. A recent analysis of data from 52 countries taking part in the World Health Survey (2002-2003) showed that 78% of respondents ate less than the minimum recommended five daily servings of fruits and vegetables.<sup>18</sup> The high percentage of low fruit and vegetable intake was seen among the rich and the poor (73.4% and 81.6 % for top and bottom income quintiles); among the

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<sup>i</sup> Industry dry down ratios vary considerable depending on the type of fruit and drying method. For example, it is approximately 1:2.5-3.5 for Mediterranean apricots; 1:3 for California plums, 1:3.3 for Calimyrna figs and 1:4-4.25 for raisins. Using a 40 g serving size this is equivalent to 100, 120 and 170 g of fresh fruit.

young and the old (Figure 1); in urban and rural areas, and for both men and women.<sup>ii</sup> Similar data are available from Australia,<sup>19</sup> South Africa,<sup>20</sup> England<sup>21</sup> and the United States.<sup>22</sup> Looking at fruit intake alone, in the US more than 75% of adult men and women fail to reach the minimum recommend level of fruit per day, intakes being low among all age groups (Table 1).<sup>23</sup> In fact, according to the recently released Dietary Guidelines for Americans (DGA), fruits are second only to whole grains in representing the largest gap between usual intake and the recommended goal (Figure 2).<sup>23</sup>

Table 1. Median intakes of fruit in the United States compared to recommended intake by age-sex<sup>1</sup>

	Median Intakes (cup equivalent)	Minimum Recommended Intake (cup equivalent)
Adult Men	0.9	2
Adult Women	0.8	1.5
Adolescent Boys	0.8	2
Adolescent Girls	0.6	1.5
Boys 9 – 13	0.8	1.5
Girls 9 – 13	0.8	1.5

<sup>1</sup>Data taken from the Report of the Dietary Guidelines for Americans Committee on the Dietary Guidelines for Americans <http://www.cnpp.usda.gov/dgas2010-dgareport.htm>

#### IV. Essential nutrients provided by dried fruits

##### a. Potassium

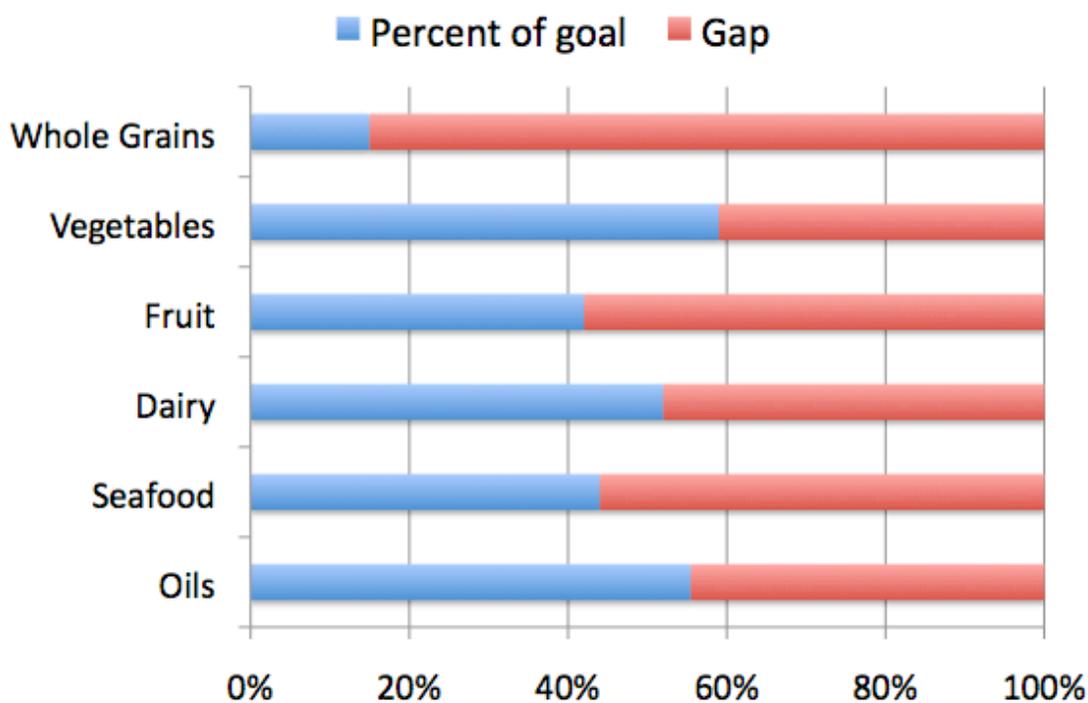
Dried fruits are a particularly significant source of dietary potassium. On a per serving basis (40 g or about 1/4 cup) dried fruits rank among the top potassium sources in diets

<sup>ii</sup> Low fruit and vegetable consumption defined as fewer than five servings or less than 400g of fruit and vegetables daily.

around the world. As can be seen from the charts below (Figure 3), dried fruits compare positively in potassium content to the most common fresh fruit options.

It is now recognized that increasing dietary potassium intake can lower blood pressure.<sup>24</sup> A higher intake of potassium also attenuates the adverse effect of sodium on blood pressure. Potassium intake is very low among most children and adults and so has

Figure 2. Usual intake of specific foods as percent of goal in the United States<sup>1</sup>

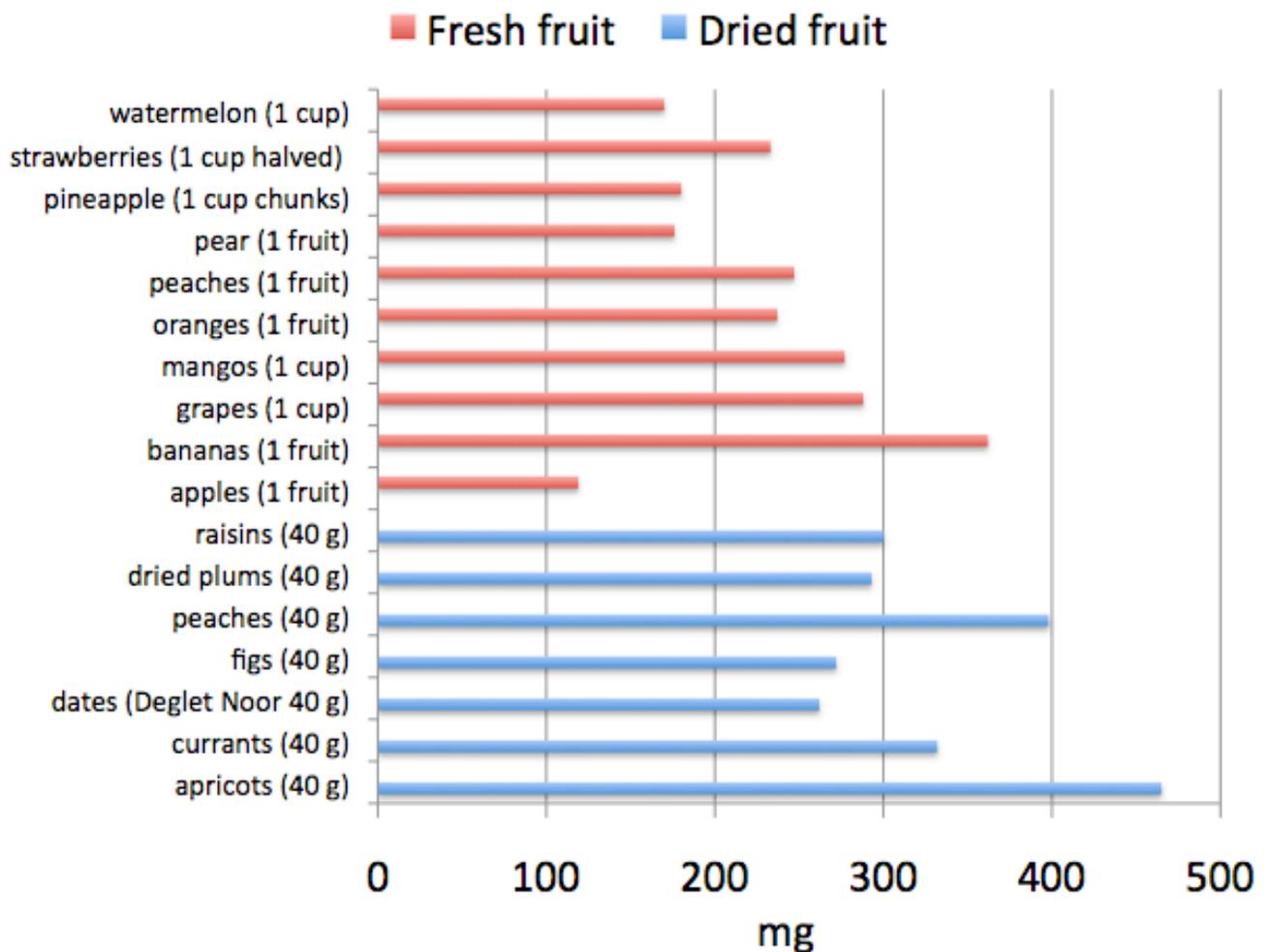


<sup>1</sup>Adapted from the Dietary Guidelines for Americans 2010. Based on data from: USDA, Agricultural Research Center and U.S. Department of Health and Human Services, Center for Disease Control and Prevention. What We Eat in America, NHANES 2001-2004 and 2005 – 2006.

become a substantial public health concern for health agencies around the world.<sup>25 26</sup> The Institute of Medicine (IOM) has set the Adequate Intake (AI) for potassium for adults at 4,700 milligrams per day. Using this value as a reference, potassium intake across countries in North America, Europe, Asia and Oceania (Figure 4) is consistently low.<sup>25</sup> Mean potassium intake range from 1,700 mg per day (China) to 3,700 mg per day (Finland, the Netherlands,

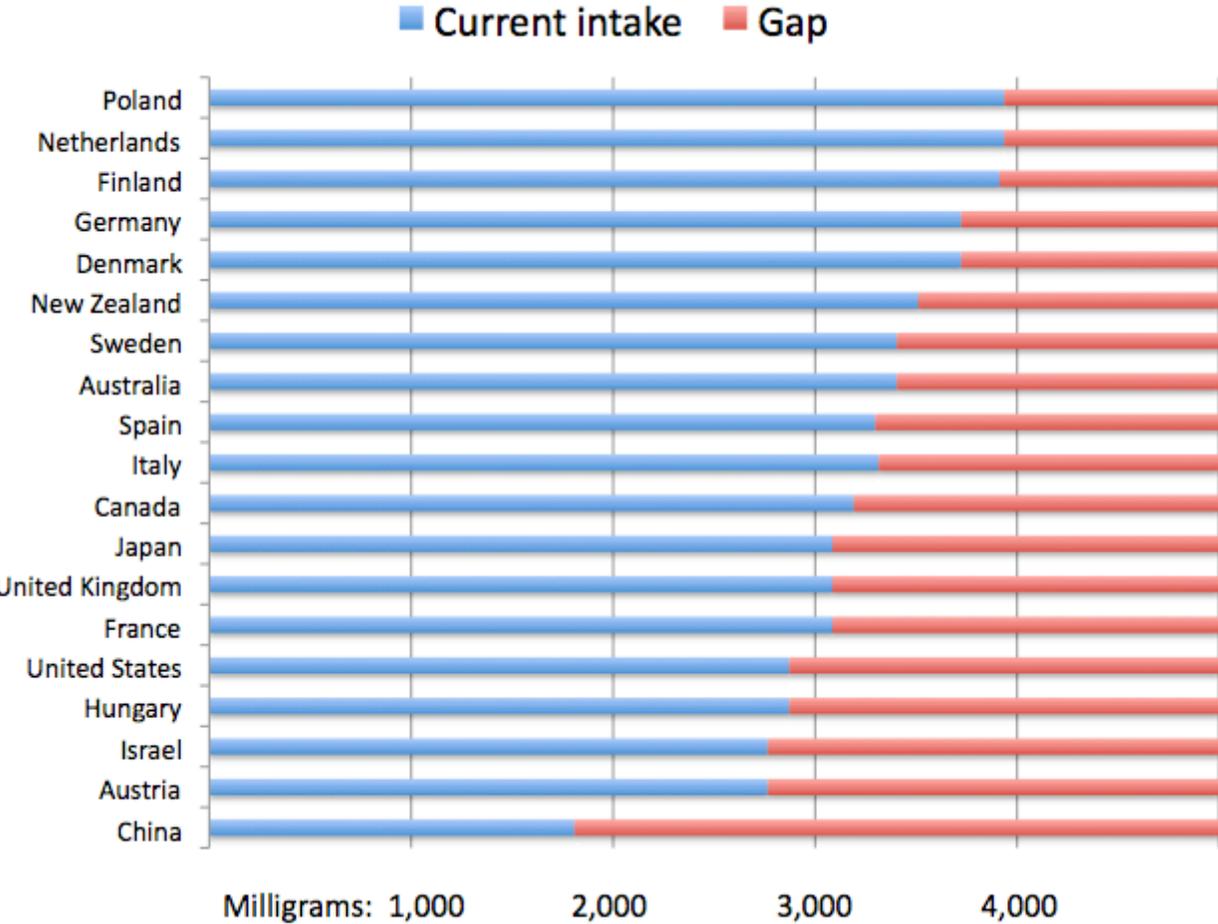
Poland). In the US usual potassium intake of the population is 56% of the recommended goal.

Figure 3. Potassium content of the 10 most commonly consumed fresh fruits<sup>1</sup> and of dried fruits<sup>2</sup>



<sup>1</sup>Weight of as follows: apple 132 g; banana 101 g; grapes 151 g; mango 165 g; orange 131 g; peach 130 g; pear 148 g; pineapple 165 g; strawberries 152 g; watermelon 150 g. These values are for standard servings. WHO recommends a minimum of 5 servings of fruit and vegetable per day or 400 g. <sup>2</sup>Data from the United States Department of Agriculture/Agricultural Research Service Nutrient Data Laboratory <http://www.nal.usda.gov/fnic/foodcomp/search/>

Figure 4. Current potassium intakes and differences from the recommended (Adequate Intake of 4,700 mg, IOM) level for different countries<sup>1</sup>

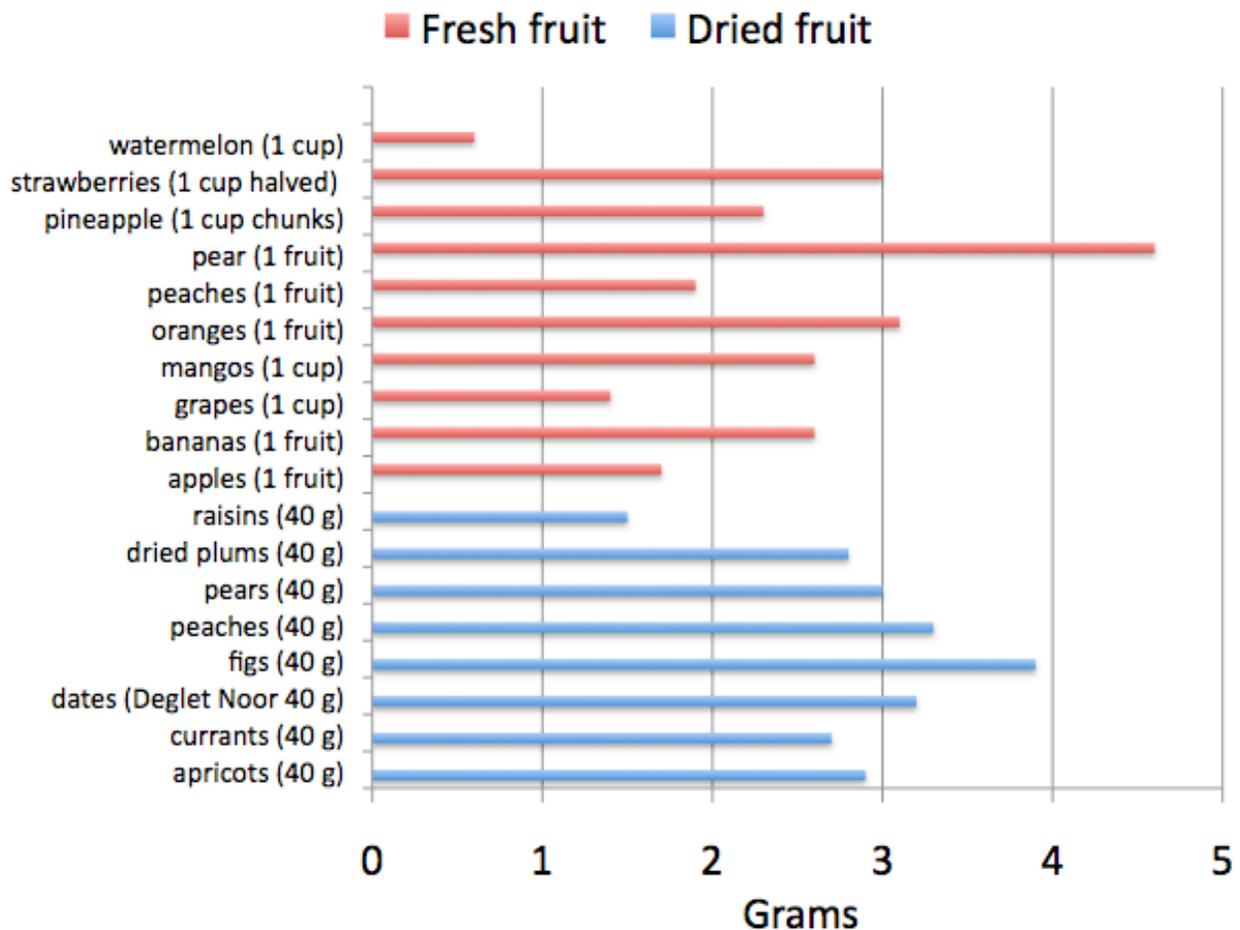


<sup>1</sup>Data for Japan taken from the NIPPON DATA 80/90 Research Group. Turin et al. J Epidemiol 2010; 20(3S): S567-S575. Data for the other countries from van Mierlo AJ et al. Arch Int Med 2010; 170(16): 1501-1502

**b. Fiber**

Dried fruits are an important source of dietary fiber. On a per serving basis (40 g or about 1/4 cup) dried fruits deliver over 9% of the daily value of fiber, depending on the fruit.<sup>27</sup> As can be seen from the charts below (Figure 5), dried fruits compare favorably in their fiber content to common fresh fruit options.

Figure 5. Fiber content of 10 most commonly consumed fresh fruits<sup>1</sup> and dried fruits<sup>2</sup>



<sup>1</sup>Weight of servings as follows: apple 132 g; banana 101 g; grapes 151 g; mango 165 g; orange 131 g; peach 130 g; pear 148 g; pineapple 165 g; strawberries 152 g; watermelon 150 g. <sup>2</sup>Data from the United States Department of Agriculture/Agricultural Research Service Nutrient Data Laboratory <http://www.nal.usda.gov/fnic/foodcomp/search/>

High fiber diets are recommended to reduce the risk of developing various conditions including constipation, type 2 diabetes, and obesity, and later in life, diverticulitis, colorectal cancer and cardiovascular disease. Health agencies around the world recommend that people consume high fiber diets. US fiber recommendations for both children and adults are 14 grams of fiber for every 1,000 calories of food consumed each day. This becomes 25 to 38 grams of fiber per day depending on age and gender. However, inadequate intake of

fiber is widespread. In the US less than 3% of Americans older than 1 year exceed the AI (38 grams) for fiber consumption.

### **c. Other essential vitamins and minerals**

Because different types of fruit differ widely in their nutrient content, national and international agencies recommend choosing from a variety. Dried peaches and apricots are an important source of provitamin A activity and carotenoids (Figure 6). Dried plums are particularly high in Vitamin K (24 micrograms per 40 gram serving or 30% DV).<sup>27</sup> Dried figs are high in calcium (over 10% daily value according to variety), and manganese (15% DV). Raisins and dried plums are among the top sources of boron in the American diet.<sup>28 29</sup> Analysis of a selection of dried fruit (sultanas, Carina currants, Zante currants, apricots and plums) from Australia, California, Turkey, Iran and South Africa, showed that they provided significant amounts of several micronutrients such as iron, manganese, copper, zinc, selenium and folic acid at levels ranging from 5 to 20% US Daily Value per 40 gram serving.<sup>30</sup> Levels differed according to drying method, and regional and varietal factors.

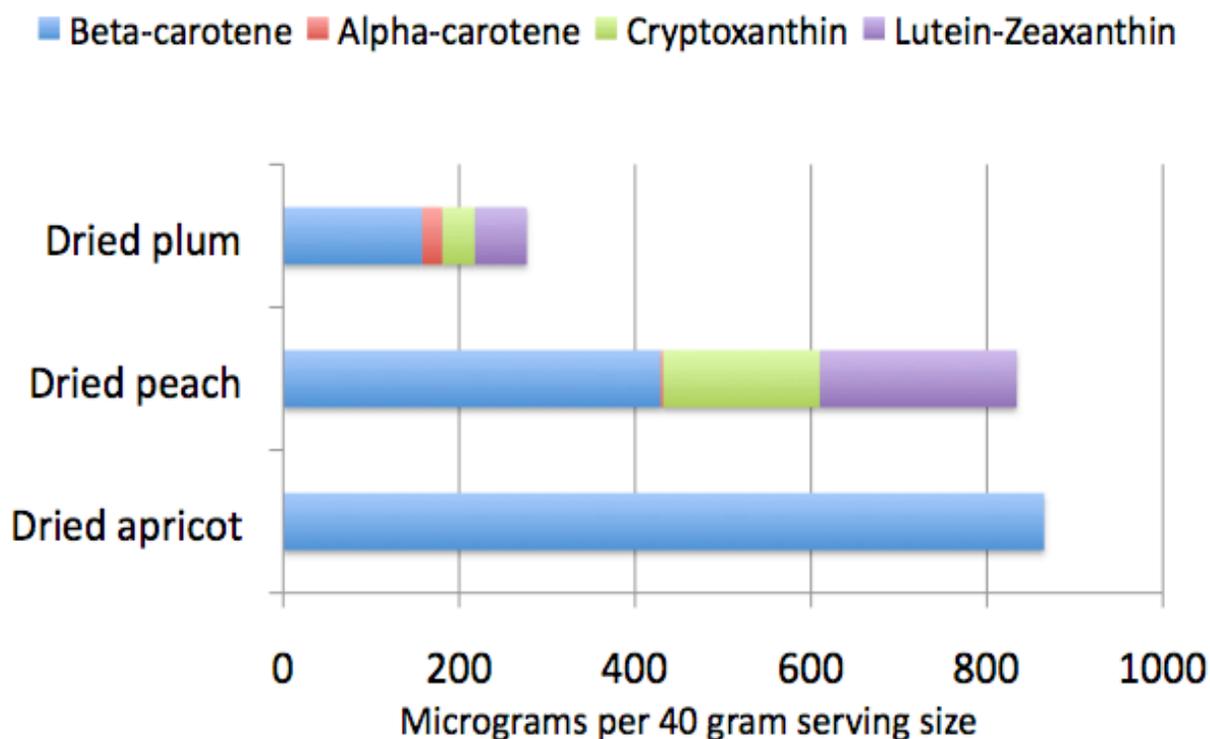
While dried fruits do not provide vitamin C, in the United States and industrialized countries intakes of vitamin C meet or exceed requirements.<sup>31 32 33 34</sup> For example, in the United States 69% of the population have intakes of vitamin C above these requirements. In the most recent DGA report the DGA Committee concludes that, “It is unlikely that vitamin C is of major public health significance for the vast majority of healthy individuals in the US.”<sup>35</sup> This is probably because in the US and many industrialized countries, children and adolescents consume more than half of their fruit intake as juice. However, while fruit juice provides potassium and vitamin C, it lacks much of the fiber of the whole fruit. Including dried fruits alongside fresh fruit in dietary recommendations expands the range of nutrients available to the population, particularly of those nutrients, fiber and potassium, that would benefit the majority of people.

## **V. Dried Fruits Lack Constituents Consumed in Excess in Western Diets**

Western diets are characterized by intake of excessive amounts of sodium, solid fats, and added sugars that replace nutrient-dense food, making it difficult for people to achieve recommended nutrient intake and control caloric value of the diet. Like fresh fruit, traditional dried fruits are free of fat, trans fats, saturated fat and cholesterol. Dried fruits also have very low sodium content. Because fruits require no fat or salt to make them

palatable, they are choice foods to reduce sodium and solid fats in the diet and are at the core of healthy dietary patterns. Traditional dried fruits also have no added sugars. Drying removes part of the fruits' water and so concentrates their natural sugars. This, however, is normalized by a smaller serving size.

Figure 6. Carotenoid and vitamin A content of selected dried fruits<sup>1</sup>



Fruit	Dried peach	Dried plum	Dried apricot
Vitamin A (IU) per 40 gram serving	865	312	1442

<sup>1</sup> Data from the United States Department of Agriculture/Agricultural Research Service Nutrient Data Laboratory <http://www.nal.usda.gov/fnic/foodcomp/search/>

## VI. Traditional Dried Fruits: Integral Part of Healthy Dietary Patterns

Diets around the world are very different, so are the diet related health outcomes such as blood pressure, risk of cardiovascular disease and total mortality. Consensus is emerging that eating diets that follow certain dietary patterns is associated with a lower risk of major

chronic diseases. Examples of these patterns are the Dietary Approaches to Stop Hypertension or DASH-style patterns, the Mediterranean style dietary patterns, and vegetarian diets. A common feature of these diets is emphasis on fruits, vegetables and other plant foods. Accordingly, fiber intake is high and saturated fat is low. Dried fruits are very common components of these types of diets. This may explain why an analysis from NHANES (1999-2004)<sup>36 37</sup> data showed that intake of dried fruit is associated with lower body mass index (BMI), reduced waist circumference and abdominal obesity. Dried fruit consumption was also associated with improved nutrient intake (higher vitamin A, vitamin K, potassium, iron, magnesium and fiber), more fruits servings per day and healthier overall diets (as measured by a significantly higher Healthy Eating Index, HEI2005) in both adults (19+) and children. While these data are associational, they suggest that those people that eat dried fruit are more likely to follow healthy eating patterns.

## **VII. Dried Fruits: A Source of Health Protective Bioactive Compounds and Antioxidant Capacity**

Dried fruits are excellent sources of phenolic compounds in the diet.<sup>38 39 40 41 42</sup> These make up the largest group of plant bioactive compounds or phytochemicals in the diet and they appear to be, at least in part, responsible for the health benefit associated with the consumption of diets abundant in fruits and vegetables. Phenolic compounds contribute the most antioxidant capacity of fruits and vegetables<sup>43</sup> and have a multitude of functional capabilities, which may have a beneficial effect on health. Values for antioxidant capacity (Oxygen Radical Absorbance Capacity or ORAC) and total phenolic content of a selection of dried fruit are shown in Table 2. Values are much higher for dried fruit than the corresponding values for fresh because antioxidants are concentrated during the dehydration process. Lipophilic ORAC values are very low in most fruits and vegetables compared to hydrophilic values, which make up 90% or more of total antioxidant capacity. While there is loss and modification of specific polyphenols during drying, total antioxidant capacity and total polyphenol content are relatively unchanged during the process, implying that many of the phenolic compounds are yet unidentified.<sup>44</sup> This could include oligomeric or polymeric products that are difficult to characterize. Proanthocyanidins detected in plum and grapes are absent in dried plum and raisins, which suggests that these compounds are degraded during the drying process.<sup>45</sup> Anthocyanins are not detected in dried fruits and are

likely degraded to phenolic acids. Much work needs to be done in this area. Available data shows that dried fruits have a unique spectrum of phenols, polyphenols and tannins. In raisins, the most abundant phenolic compounds are the flavonoids quercetin and kaempferol, and the phenolic acids caftaric and coumaric acid.<sup>46</sup> The predominant phenolic compounds in Greek currants are vanillic, caffeic, gallic, syringic, *p*-coumaric, and protocatechuic acids and the flavonoid quercetin.<sup>47</sup> Hydroxycinnamates, especially chlorogenic acid isomers are the major phenolics in dried plums, representing more than 94% of the total.<sup>48</sup> Rutin is the predominant flavonol.<sup>49</sup> Dried plums also contain quinic acid that is metabolized to hippuric acid, which some research suggests helps prevent urinary tract infections.<sup>50</sup> <sup>42</sup> Information on phenolic compounds in dates is complex since composition varies significantly according to variety and maturation stages.<sup>51</sup> <sup>52</sup> Very little information is available on the antioxidant characterization of other dried fruits.

Table 2. Total phenolic content and antioxidant activity of dried fruits, grapes and plums<sup>1</sup>

Dried Fruit	Total Phenolics (mg of GAE/g wet weight)	L-ORAC ( $\mu\text{m TE/g}$ )	H-ORAC ( $\mu\text{m TE/g}$ )
Deglet Noor dates	6.6 $\pm$ 1.1	0.32 $\pm$ 0.16	39 $\pm$ 3
Medjool dates	5.7	0.27	24
Dried figs	9.6 $\pm$ 0.1	1.8 $\pm$ 0.1	32 $\pm$ 3
Dried plums	12 $\pm$ 1.6	1.8 $\pm$ 0.6	84 $\pm$ 17
Raisins	10.7 $\pm$ 1.6	0.35 $\pm$ 0.13	30 $\pm$ 5
Grapes	1.5 $\pm$ 0.1	-	11 $\pm$ 2
Plums	3.6 $\pm$ 1.1	0.17 $\pm$ 0.1	62 $\pm$ 20

<sup>1</sup> Data from the United States Department of Agriculture/Agricultural Research Service Nutrient Data Laboratory <http://www.nal.usda.gov/fnic/foodcomp/search/>

## VIII. Dispelling Myths

Contrary to the popular perception that dried fruit promote cavities, recent studies indicate that they may actually promote oral health. Bioactive compounds found in raisins

and dried plums appear to have antimicrobial properties that inhibit the growth of bacteria that cause cavities and gum disease.<sup>53</sup> Dried fruits also exhibit rapid clearing rates, placing them among the least retentive foods within a sample of snack foods.<sup>54</sup> Raisins have been shown to attenuate acidogenicity of eating cereals;<sup>55</sup> and to block *in vitro* biofilm formation and adherence of bacteria to experimental surfaces.<sup>56</sup> Finally, most dried fruits contain minimal amounts of cariogenic sucrose.

Another misconception is that dried fruits, because of their sweetness, exert a high glycemic and insulin response. Recent studies actually show that traditional dried fruits have a low to moderate glycemic and insulin index (Table 3) and a glycemic and insulin response comparable to fresh fruits.<sup>57 58 59 60</sup> This could be due to the presence of fiber and polyphenols, phenols and tannins that can modify the response.<sup>61 62 63 64</sup> Foods with a low glycemic index may help to decrease the risk of diabetes and are useful in the management of the established condition.

Table 3. Glycemic Index of traditional dried fruits

Fruit	Glycemic Index	
Dried apricots <sup>1</sup>	30	
Dried peaches <sup>2</sup>	35	
Dried plums <sup>3</sup>	29	
Raisins <sup>4</sup>	52	
Dates <sup>5</sup>	39	
Dried apples <sup>6</sup>	29	
Dried Figs <sup>7</sup>	61	

1 Average of 3 reported values. Glycemic Index Database: Sydney University's Glycemic Index Research Service (SUGiRS) Human Nutrition Unit, School of Molecular and Microbial Biosciences, Sydney University <http://www.glycemicindex.com>.

2, 3, 6, 7 Glycemic Index Database SUGiRS (see above)

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## IX. Other Reported Health Benefits Specific to Dried Fruits

### **Dried fruits promote digestive health.**

There is considerable research supporting the role of dried fruit particularly in regulating bowel function and maintaining a healthy digestive system.<sup>65 66</sup> Recently published research shows that dried plums are more effective than psyllium for the treatment of mild to moderate constipation, and should be considered as a first line therapy.<sup>67</sup> Studies also indicate that raisins also provide prebiotic compounds such as fructans, which may help to maintain intestinal balance and colonic health.<sup>68 69</sup>

### **Dried fruits, particularly dried plums, may promote bone health.**

Research conducted with dried plums indicates that they have a role in supporting bone health. Animal studies show that dried plums reduce loss of bone in different models of osteoporosis.<sup>70 71 72</sup> This may be because they are rich in phenolic compounds, such as phenolic acids and lignans, which may stimulate bone formation and enhance osteoblast activity.<sup>73</sup> Dried fruits have also been found to contain isoflavones that may contribute to the effect.<sup>74 75</sup> Dried fruits are a good source of other nutrients reported to influence bone health including calcium, magnesium, vitamin K and boron. For example, 100 g of dried figs has higher calcium content than the same quantity of milk. Boron is postulated to play a role in osteoporosis prevention and low boron intakes have been shown to impair bone strength.<sup>76</sup>

## X. Dried Fruits and Dietary Recommendation in Different Countries

Traditional dried fruits qualify for the Produce for Better Health Foundation's "Fruit & Veggies: More Matters" logo, which requires that nothing be added to the fruit that alter their nutritional value. The Dietary Guidelines for Americans have long considered dried fruits as "whole foods" nutritionally equivalent to fresh fruit.<sup>iii</sup> Dried fruits are also included as equivalent to fresh fruit (in smaller serving sizes) in current dietary recommendations in Argentina, Australia<sup>iv</sup>, Britain<sup>v</sup>, Canada, France, Germany, Italy<sup>vi</sup> and Sweden.<sup>77</sup> It is important to note that while all of these countries emphasize variety in fruit selection, some (i.e. UK, South Africa and Australia) limit the amount of dried fruit that should be consumed

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<sup>iii</sup> ¼ cup of dried fruit (ranging from 36 to 43 grams, depending on the fruit) counts as one serving of fruit.

<sup>iv</sup> Only 1 serving per day because dried fruits may "contribute to tooth decay."

<sup>v</sup> Serving size is 30 grams.

<sup>vi</sup> Raisins and other dried fruit can "improve digestive health"

on a daily basis. This is counterintuitive as some dried fruits are, and have been for centuries, staple foods in different regions of the world making a significant contribution of the dietary requirements of their populations.

## **XI. Conclusion**

Dried fruits should be included side by side with fresh fruit recommendations around the world because they help meet dietary guidelines for daily fruit servings and address barriers to fruit intake. The greatest benefit of including dried fruits regularly in the diet is that it is a means to increase overall consumption of fruit and the critical nutrients they contain. Dried fruits have the advantage of being easy to store and distribute, available year round, they are readily incorporated into other foods and recipes, relatively low cost and present a healthy alternative to sugary snacks. The scientific basis for recommending higher fruit intake is the epidemiological evidence that individuals who regularly eat generous amounts of these foods have lower rates of cardiovascular disease, obesity, several cancers, diabetes and other chronic disease. Yet today the majority of populations eat diets that are low in fruit and vegetables and consequently low in the nutrients they provide. Traditional dried fruits, with their unique combination of essential nutrients, fiber and bioactive compounds are a convenient step toward healthier eating and a means to bridge the gap between recommended intake of fruits and actual consumption.

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