Dried Plums & Digestive Health

A Broadening Perspective on Dried Plums in Digestive Health

The importance of digestive health in total health is beginning to be appreciated in the United States, not only because of the climbing rates of digestive diseases, but also because of scientific advances in understanding the impact of digestive health on the well being of the entire organism. At the same time, nutrition science is revealing new aspects of the role of dried plums in digestive health, beyond their reported role in laxation. Research on the components of dried plums indicates that they are high not only in insoluble fiber, but also in soluble fiber and phenolic compounds. These compounds may influence the health of the gastrointestinal (GI) tract and beyond, including cardiovascular health and possibly cancer resistance. A broader understanding of the role of dried plums in digestive health, then, encompasses their direct actions in the GI tract, including potential effects on the GI microflora, as well as indirect effects on health throughout the body.

Relevant components of dried plums

Dried plums contain more than 6 grams of dietary fiber per 100 g serving, of which approximately half is soluble and half insoluble. The fiber types include cellulose, hemicellulose and lignin (insoluble) and pectin (soluble). Sugars are present as fructose, glucose and sorbitol, and the principal phenolic compounds are chlorogenic acid, neochlorogenic acid and caffeic acid (Table 1).

Table 1. Selected components of plums, dried plums and prune juice per 100 g serving[1]

Component	Fresh Prune-making Plums	Dried Plums	Prune Juice
Sugars			
Glucose	6.1 g	23.1 g	0.01g
Fructose	3.4 g	13.1 g	6.2 g
Sucrose	4.5 g	0.6 g	—-
Sorbitol	5.4 g	14.7 g	6.1 g
Total dietary fiber	1.5 g	6.1 g	0.01 g
Pectin	0.76 g	2.1g	—-
Cellulose	0.23 g	0.9 g	—-
Hemicellulose	—-	3.0 g	—-
Lignin	0.30 g	0.2 g	—-
Major phenolic compounds			
Neochlorogenic acid	81 mg	131 mg	22.5 mg
Chlorogenic acid	14.4 mg	44 mg	19.3 mg
Caffeic acid	—-	0.9 mg	0.3 mg
Coumaric acid	—-	1.0 mg	0.4 mg
Rutin	2.5 mg	3.3 mg	0.4 mg

Adapted from Stacewicz-Sapuntzakis et al, 2001.

Impact of the GI Tract on Health

The GI tract is the second largest body surface area after the respiratory tract and is exposed to some 60 tons of food passing through it during a lifetime. Its mucosal surfaces — a monolayer of epithelial cells covered by mucus — are the body's first line of defense against toxins and infections from pathogenic bacteria, viruses or parasites. This defense is modulated by the GI microflora (the "friendly" bacteria) and the GI-associated musocal immune system. A healthy balance of the GI microflora is essential for the development and proper functioning of the musocal immune barrier.[2,3] A type of dietary fiber — fructo-oligosaccharides (fruit fibers) — has been shown to stimulate the growth of lactic acid-producing bacteria such as bifidobacteria,[4] which have been shown to exert a number of positive effects on health.[5]

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Short Chain Fatty Acids

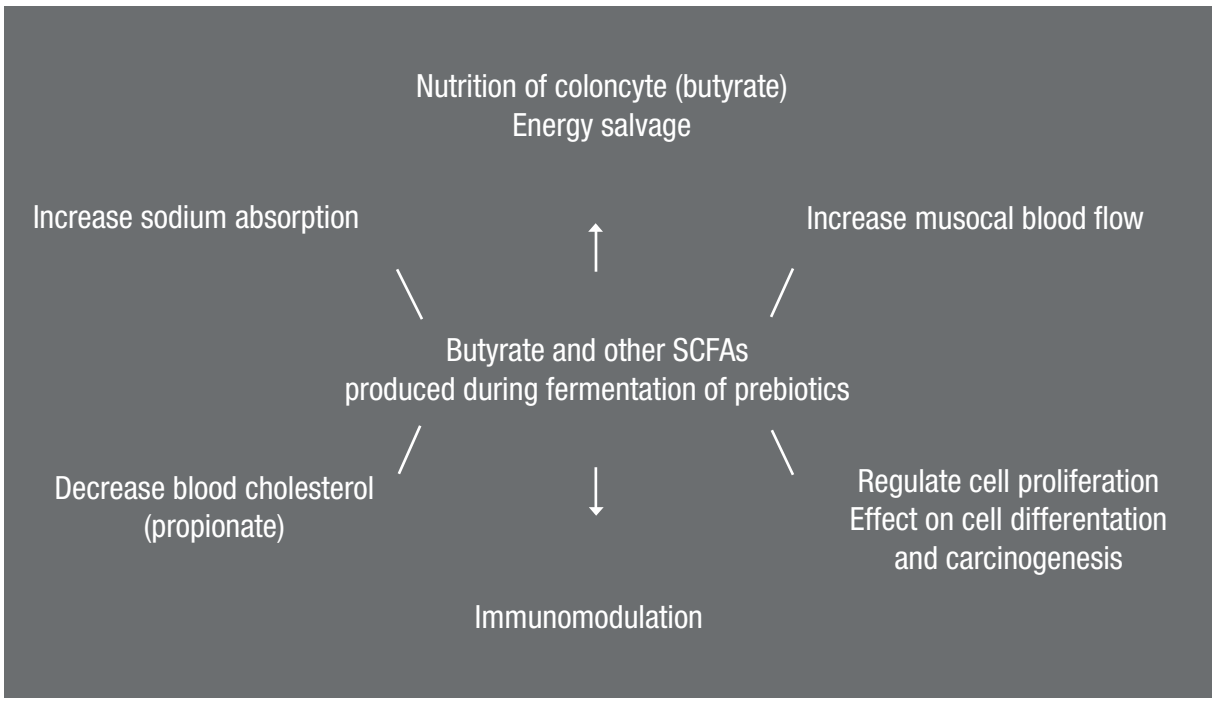
The portion of dietary fiber that is not digested and passes into the colon becomes available for fermentation. Fermentation of dietary fiber increases the production of short chain fatty acids (SCFAs) including acetate, propionate and butyrate.[6] These SCFAs lower the pH of the colon.[4] By acidifying the colonic environment, SCFAs play an important role in both colonic and systemic physiology. Butyrate has received scientific attention for its ability to regulate genes that control cell proliferation and differentiation, which has implications for prevention of colon cancer. Both colon cancer and inflammatory bowel disease have been associated with decreased concentrations of butyrate, and some studies have shown that administration of butyrate may be useful for prevention or treatment of experimental colitis. Furthermore, animal studies have shown that administration of fructo-oligosaccharides decreased tumor formation and/or the formation of aberrant crypt foci, a marker for colon cancer risk.[4]

Another mechanism potentially affecting cancer risk is the reduction of secondary bile salts, which occurs as a result of the lowered pH of the colonic environment. The conversion of primary bile salts to secondary bile salts is inhibited when the pH is below 6.5. One team of investigators showed recently that chronic administration of fructo-oligosaccharides increased the excretion of primary bile salts in people with colon polyps and suggested that fructo-oligosaccharides may be useful in colon cancer prevention.[4]

In another experiment with human volunteers, fecal concentration of secondary bile acids was significantly lower after ingesting 100 g/day of dried plums for four weeks.[1]

All three SCFAs serve as fuel sources for different cells, with butyrate being the preferred fuel of colonocytes. Proprionate is absorbed from the colonic lumen and transported to the liver, where it is thought to reduce cholesterol production. Acetate is transported to various tissues for fuel.[4,6] Multiple physiological roles of butyrate and other SCFAs produced during fermentation of prebiotics in the colon are shown in Figure 1.

Figure 1. Physiological effects of butyrate and other SCFAs produced in the colon[4]



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The Cholesterol Connection

There are basically two ways to reduce cholesterol — either to increase excretion or to suppress production of cholesterol in the liver. Cholesterol can be reabsorbed from the intestines and cycled back to the liver via the enterohepatic circulation; in the liver it can be catabolized, and the bile acids which are the metabolites of this process can be measured in the feces. The soluble fiber pectin, which accounts for 40-60% of the total fiber content of dried plums, has been shown to reduce plasma cholesterol levels.[7,8] Viscous fibers including pectin have been shown to increase fecal bile acid losses, and this has been proposed as one mechanism by which soluble fiber lowers serum cholesterol.[8] However, the effect has not been seen in all studies.[7] Soluble fiber may reduce hepatic free cholesterol and triaglycerol while also upregulating the activity of the enzyme responsible for cholesterol catabolism.[9] Pectin has also been shown in laboratory animals to decrease the susceptibility of low density lipoprotein cholesterol (LDL) to oxidation, and this may be another mechanism by which soluble fiber protects cardiovascular health.[10]

Furthermore, the production of SCFAs in the gut may decrease serum cholesterol levels by inhibiting hepatic cholesterol synthesis and/or redistributing cholesterol from plasma to the liver.[11] It has been suggested that some bacteria present in the GI microflora may have the ability to assimilate cholesterol directly, or to interfere with cholesterol absorption from the gut by deconjugating bile salts and therefore affecting the metabolism of cholesterol.[11]

Whatever the mechanism, it is clear that an interplay exists between the GI system and the cardiovascular system, so in a sense the impact of fiber on cholesterol levels may be seen as an “indirect effect” of digestive health.

Laxation

Dried plums have been consumed by humans for centuries for their positive effects on laxation. In recent human experiments, ingestion of 12 dried plums daily increased fecal bulk by about 20%,[7] and consumption of a very high fruit and vegetable diet for two weeks significantly increased fecal weight, bulk and water content.[8] Fiber has a known osmotic quality, but may also alleviate constipation by improving the GI microflora.[12] Both sorbitol and phenolics may increase the amount of glucose passing into the bowel, making it available for fermentation.[1] Additionally, phenolics influence the electrolyte balance in the intestinal tract and were shown to induce contractions in isolated intestinal sections from laboratory animals.[1] Thus, the laxative effect of dried plums is likely due to the combined action of fiber, sorbitol and phenolic compounds.

Prune juice also produces a laxative effect similar to whole dried plums, although most brands of prune juice are nearly devoid of fiber. This is attributed to its sorbitol and phenolic content.[1] However, some brands of prune juice now have added pulp and may provide about 2 g of dietary fiber per serving; one brand, in fact, has almost as much fiber per serving as dried plums.

Summary

The impact of dried plums on digestive health extends beyond their laxative effects and invites a holistic perspective encompassing the multifaceted, systemic impact of GI health on the entire body. Increased production of SCFAs may have beneficial effects on both cardiovascular health and the resistance to cancer. Other potential health benefits of dried plums related to their nutrient profile and phenolic content, while important and impressive, are beyond the scope of the present discussion.

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