Recent Research in Science and Technology 2014, 6(1): 283-286
ISSN: 2076-5061
Available Online: http://recent-science.com/

Therapeutic fruit peels: Their role in preventing lifestyle disorders

Shilpi Chatterjee

Jagadguru Shankaracharya College of Nursing, Raipur, India.

Abstract
The prevalence and severity of obesity, type 2-diabetes, cardiovascular disease, cancer and respiratory problems are rapidly increasing. As successful preventive and therapeutic strategies for these life-threatening health ailments often come with adverse side effects, nutritional elements have been widely used in many countries as preventive therapies to prevent or manage metabolic syndrome. Fruits are important dietary components and contain various bioactive constituents such as flavonoids, carotenoids and phenols. Evidence suggests that a diet high in fruits and vegetables may decrease the risk of chronic diseases, such as cardiovascular disease and cancer, and phytochemicals including phenolics, flavonoids and carotenoids from fruits and vegetables may play a key role in reducing chronic disease risk. Although various fruits have already been studied worldwide in this connection but the peels of the fruits have mostly remain an underdog. The aim of this article is to review the role of peel of the fruits and their constituents in the regulation of metabolic functions which can beneficially alter the pathophysiology of some of the common as well as chronic ailments.

Keywords: Therapeutics, Lifestyle, Disorders

INTRODUCTION

Human and animal wastes are biodegradable. Kitchen wastes make up the bulk of household wastes. Crop residues and animal manure are now being used to build up organic matter in the soil. Such practice supports sustainability as it replenishes nutrients by recycling all elements [1]. By looking at the phytochemistry of wastes like fruit peels, possible nutritional and medicinal substances may be discovered. The environment is continually deteriorating. Biodegradable wastes increase with the increasing population. The problem in wastes affects the integrity of the earth. Problems in health and nutrition are common. Finding important chemicals from fruit peels like total sugars or carbohydrates, as well as alkaloids will help address daily challenges in nutrition and health. Nowadays, there is a growing interest in finding phytochemicals as an alternative to synthetic substances which are commonly used in the food, pharmaceutical and cosmetic industry. This idea is supported by the consumer's concern about the safety of products containing synthetic chemicals because these synthetic molecules are suspected to cause or promote negative health effects. Recent studies showed that the phytochemicals in fruits and vegetables are the major bioactive compounds with human health benefits. Epidemiological studies have pointed out that the consumption of fruits and vegetables imparts health benefits, e.g. reduced risk of coronary heart disease and stroke, as well as certain types of cancer. Apart from dietary fibre, these health benefits are mainly attributed to organic micronutrients such as carotenoids, polyphenolics, tocopherols, vitamin C and others.

*Corresponding Author

Shilpi Chatterjee
Jagadguru Shankaracharya College of Nursing, Raipur

Food has now assumed the status of "functional food", which should be capable of providing the additional physiological benefit, such as preventing or delaying onset of chronic diseases, as well as meeting basic nutritional requirements. Any food or ingredient that has a positive impact on an individual's health, physical performance is a state of mind in addition to its nutritive value. Manufacturers who care and are willing to meet the requirements of the consumers for safe and functional food are introducing natural antioxidants during the production and/or processing. It has been evident that the consumption of food rich in natural antioxidants, as well as food enriched with them ensure the desirable antioxidant status and helps in prevention of the development of diseases caused (linked) by oxidative stress.

Epidemiological studies have related the dietary consumption of horticultural products, mainly fruits and vegetables, with a decrease in the incidence of cancer and cardiovascular disease mortality. Clinical studies support the role of the plant food phytochemicals as health-promoting functional food components. The role of antioxidant phytochemicals in the prevention of these diseases has been mainly attributed to the prevention of LDL oxidation through a scavenging activity against peroxyl and hydroxyl radicals. India is the second largest producer of fruits and vegetables in the world. Of the 370 million tonnes of fruits harvested globally, India accounts for 30 million tonnes. It is the world's largest producer of mangoes and bananas; a significant player in the cultivation of pineapple and oranges besides a wide range of tropical and other fruits. The processing of fruits, vegetables and oilseeds result in high amounts of waste materials such as peels, seeds, stones, and oilseed meals. A disposal of these materials usually represents a problem that is further aggravated by legal restrictions. Plant waste is prone to microbial spoilage; therefore drying is necessary before further exploitation. The cost of drying, storage, and transport possess additional economical limitations to waste utilization. Therefore, agroindustrial waste is often utilized as feed or fertilizer. Thus new aspects concerning the use of these wastes as by-

products for further exploitation on the production of food additives or supplements with high nutritional value have gained increasing interest because these are high-value products and their recovery may be economically attractive. It is well known that by-products represent an important source of sugars, minerals, organic acids, dietary fibre, and bioacitive compounds such as phenolic compounds. Phenolics are a much diversified group of secondary plant metabolites, which includes simple phenolic, phenolic acids (benzoic and cinnamic acid derivatives), lignans, lignins, coumarins, flavonoids, stilbenes, flavonolignans and tannins [2]. Many of phenolic compounds have shown strong antioxidant properties as oxygen scavengers, peroxide decomposers, metal chelating agents, and free radical inhibitors [3, 4]. Besides antioxidant activity, phenolic compounds have a wide range of action which includes antitumoral, antiviral, antibacterial, cardioprotective, and antimutagenic activities.

Thus, new aspects concerning the use of these wastes as by-products for further exploitation on the production of food additives or supplements with high nutritional value have gained the increasing interest because these are high-value products and their recovery may be economically attractive. Fruit peel is basically the outer skin or the covering of fruits. In general, the peel in some tough-skinned fruits such as pomegranate, passion fruit, mangosteen…etc., is known as the rind, where as in citrus fruits such as in oranges, it is better termed as zest. While the outer cover protects the fruit from environment, micro, and macro organisms, it indeed has several phyto-nutrients that help to maintain good health. Far from claiming completeness, this review discusses the potential of peels of some common fruits as a source of valuable compounds.

Functional compounds from fruit peels

Apple

In the past five years, no area of apple research has been more dynamic than the area of apple polyphenols. The balance of these phytonutrients in apples is far more unique than many researchers previously suspected. In terms of flavonols, quercetin is the primary phytonutrient found in apples and it's far more concentrated in the skin than in the pulp. Kaempferol and myricetin are also important apple flavonols. Chlorogenic acid is apple's primary phenolic acid, and it's found throughout the pulp and also in the skin. If apples are red, it's because of their anthocyanins, which are largely restricted to the skin. When an apple is more uniformly red in color, or when its red color is deeper in hue, it's because there are more anthocyanins. In terms of catechin polyphenols, epicatechin is the primary nutrient found in apples. The flavonoid phloridzin accounts for 98% of the flavonoids found in the apple seeds. The total polyphenol contents of apples range from about 1-7 grams/kilogram of fresh pulp, but this ratio gets much higher in the skin, underscoring the special value of apple skins for deriving optimal polyphenol benefits from this fruit. In fact, in animal studies, there is a very commonly used standardized apple extract called standardized apple peel polyphenol extract, or APPE.

It is also interesting to note that the amazing polyphenol content of apples is related to their easy browning when sliced open or bruised. Inside the cells of apple skin and pulp are enzymes called polyphenol oxidases or PPOs. When the cells of the apple are sliced through or physically damaged or when an apple is dropped, the PPOs start oxidizing the polyphenols in apples, and the result we see is a browning of the damaged apple portion. It's important to handle apples delicately in order to protect their health-supportive polyphenols.

Apple peel is the nutrient storehouse of the apple. A person, who leaves out the peel while having the apple, fails to enjoy the actual nutritional value of the fruit.

Apple peel is a rich source of mostly all types of vitamins. Among all types of vitamins present in the apple peel, amount of vitamin A & C is more from others. A study conducted at University of Illinois came out with the conclusion that half of the vitamin C of the apple is present in its skin alone. While vitamin A is excellent for the eyesight and skin, vitamin C is the finest nutrient for strengthening immunity system. The same vitamin is also very good for the health of the skin. In addition to these vitamins, apple peel is also rich in vitamin K and folates. A vitamin called choline present in apple is quite helpful for building new body cells.

Apple peel is equally good in minerals. It is highly rich in calcium and phosphorous. In addition, there is an adequate amount of zinc, sodium, and magnesium present in the apple peel. Iron quantity in apple is satisfactorily high, and therefore makes a healthy food option for anaemic patients. The expecting women are often prescribed to eat this fruit in adequate amount due to the abundance of folic acid and iron. The calcium and iron are also good for bone and teeth health. It is a significant source of edible fibre. The fibre in apple skin is present in both soluble and insoluble form. About two-third of the apple's fibre is present in the peel alone. The presence of fibre makes it an ideal weight loss fruit. It targets the fat tissues of the body to melt down, and cleanses the immune system effectively. Eating an apple with the skin regularly is good for comfortable bowel movement too. This helps to maintain a healthy cardiovascular and digestive system. Apple peels are greatest source of natural antioxidants. If you are in search of a fruit that tops in antioxidant photochemical such as phenolic acid and flavonoid, pick up an apple confidently. The antioxidants act as a protector from the impurities, free radicals, and destructive molecules. The apple peel, effectively trigger free radicals that often lead to brunch of health disorders. Eating an apple daily is therefore extremely important to resist diseases like heart attack and diabetes. A recent study conducted at the University of Illinois reveals that apple contains a compound called triterpenoid that has the ability to fight with harmful cancer creating cells. Apple peel efficiently reduces the risk of liver, breast, and colon cancer.

Orange

Like most fruits, oranges are full of nutrients and enzymes that help our bodies perform better. Orange peels are rich in flavonones, powerful antioxidants that help reduce oxidative damage and fight free radicals. Orange peel is also loaded with natural histamine suppressing compounds. Perhaps one of the most amazing and beneficial qualities of orange peel is its histamine and irritation reducing action, which adds to its already long list of reasons for being highly effective as a lung cleansing herb. Although the high concentration of histamine reducing compounds in orange rind is effective at providing support for problematic respiratory indications, its benefits extend further. Orange peel provides effective support against respiratory distress. It has a lung cleansing effect by breaking down and helping expel congestion. Eating orange peels also provides other tremendous benefit. It's not just the fruit that's loaded with vitamin C, the rind is too, as well as vitamin A, enzymes, fiber, and pectin. Vitamin C is a fantastic immune system booster that can help fight the symptoms of cold and flu. The taste is somewhat bitter when eaten by itself but many people get used to it,

or simply add it to other recipes. In pureed form, orange peel is easy to add to a smoothie or as an extra ingredient in fruit and nut bars. Mixing it with other ingredients can make the taste more palatable. Dehydrated orange peel powder can even be added to a bath for an aroma therapeutic effect to cleanse the lungs of congestion or other respiratory irritation. The peel actually contains four times more fiber than the entire orange. They are filled with flavonoids that are known as cancer fighters, namely tangeretin and nobiletin. Orange peels also contain d-limonene, which has been found to fight UV rays and reduce the risk of skin cancer. Until recently orange peels have also been used to make biodegradable plastic in Brazil.

Banana

Banana peels are the thick ropey-textured and green to yellow colored skin of bananas. In western society, banana peels are discarded while the flesh is eaten. Banana peels are rich in soluble fiber as well (just like apple peel) which can help us maintain a healthy weight by making us feel full. Studies have also shown soluble fiber to reduce the risk of heart attacks and avert early onset of diabetes. The soluble fiber contained in banana peel (and banana flesh too) is also importantly used in lowering cholesterol levels. Soluble fiber has been extensively studied and proven to reduce the levels of low density lipoprotein, LDL or 'bad' cholesterol.

Clinical studies conducted on the properties of banana peel discovered that banana peel contains a particular substance called tryptophan. Tryptophan is an essential amino acid that is needed for the production of hormones like serotonin, a brain hormone, which acts as a mood booster. This property is found in banana flesh as well. Anti-oxidants are the much-pursued miracle substances which offer sublime anti-aging benefits. Banana peel has been found to be rich in polyphenols and carotenoids, which are phytochemicals with antioxidant properties. Studies have found that unripe banana peel contains more of these anti-oxidants than ripe banana peel. Another antioxidant found in banana peel is 'lutein', is known to reduce oxidative stress and neutralize free radical damage in various organs, including the skin. But lutein is also known to provide nutritional sustenance to the eyes – by not only reducing the risks of macular degeneration and cataracts, but by also filtering out harmful UV rays from damaging the eyes, as well as protecting cells in the eyes from free radical damage. Researchers suggest a minimum of 6mg – 10mg is required daily to derive the benefits of lutein.

Pomegranate

The peels of a pomegranate fruit contain double the antioxidants that the pulp contains. We can not only benefit from the juice of the arils, but the antioxidants contained in the peel too. Pomegranate peels yield more of the powerful antioxidants such as flavonoids, phenolics, and proanythocyanidins than what the pulp yields. Even the tests performed to test antioxidant activity showed that the peels of the pomegranate fruit had higher activity levels than the pulp. These findings are interesting in that the antioxidant activity in the peels was more successful in protecting LDL cholesterol against oxidation. This is very important because oxidative stress can lead to heart disease and other medical conditions; high antioxidant activity can be one way to fight this state that is so harmful to the body. The peels of pomegranates were once considered to be the wasted part of this amazingly healthy fruit. However, as the research continues into the health benefits of pomegranate fruit, seeds, and now the peels, it is obvious that this ancient fruit of Biblical times could be beneficial in more ways than we could imagine at present.

Tomato

Tomatoes contain lycopene which helps to prevent several types of cancer. A number of studies have been conducted that indicate that the high levels of lycopene in tomatoes works to reduce our chances of developing prostate, colorectal and stomach cancer. Lycopene is a natural antioxidant that works effectively to slow the growth of cancerous cells. Tomatoes help to maintain strong bones. Tomatoes contain a considerable amount of calcium and Vitamin K. Both of these nutrients are essential in strengthening and performing minor repairs on the bones as well as the bone tissue. The skin of the tomatoes contains coumaric acid and chlorogenic acid that work to protect the body from carcinogens that are produced from cigarette smoke. Tomatoes provide essential antioxidants and contain a great deal of Vitamin A and Vitamin C. This is primarily because these vitamins and beta-carotene work as antioxidants to neutralize harmful free radicals in the blood. Free radicals in the blood stream are dangerous because it may lead to cell damage. Tomatoes are good for our heart as well as Vitamin B and potassium are effective in reducing cholesterol levels and lowering blood pressure. Therefore, by including tomatoes in our regular balanced diet we can effectively prevent heart attacks, strokes as well as many other heart related problems that may threaten our life.

Future trends

The exploitation of fruit peels as a source of functional compounds and their application in food is a promising field which requires interdisciplinary research of food technologists, food chemists, nutritionists and toxicologists. In the near future, we are challenged to respond to the following research needs. Furthermore, investigations on stability and interactions of phytochemicals with other food ingredients during processing and storage need to be initiated. Since functional foods are on the boundary between foods and drugs, their regulation still proves to be difficult. In any case, a consumer protection must have priority over economic interests.

REFERENCES

[1]Dixit Y, Kar A. 2009. Antioxidative activity of some vegetable peels determined *in vitro* by inducing liver lipid peroxidation. Food Research International. 42:1351-1354.

[2]Duda-Chodak A, Tarko T. 2007. Antioxidant properties of different fruit seeds and peels. Acta scientiarum polonorum. Technologia alimentaria. 6(3):29-36.

[3]Guimarães R, Barros L, Barreira JC, Sousa MJ, Carvalho AM, Ferreira IC. 2010.Targeting excessive free radicals with peels and juices of citrus fruits: grapefruit, lemon, lime and orange. Food Chemical Toxicology. 48(1):99-106

[4]Hegazy AE, Ibrahium MI. 2012. Antioxidant Activities of Orange Peel Extracts. World Applied Sciences Journal.18(5):684-688.

[5]Kondo S., Tsuda K., Muto N., Ueda J., 2002. Antioxidatative activity of apple skin or flesh extracts associated with fruit development on selected apple cultivars. Sci. Hort. 96, 177-185.

[6]Kubola J, Siriamornpun S. 2011. Phytochemicals and antioxidant activity of different fruit fractions (peel, pulp,aril and seed) of Thai gac (*Momordica cochinchinensis* Spreng). Food Chemistry.127:1138-1145

[7]Peschel W, Sanchez-Rabaneda F, Diekmann W, Plescher A, Gartzia I, Jimenez D *et al*., 2006. An industrial approach in the search of natural antioxidants from vegetable and fruit wastes. Food Chemistry. 97(1):137-150.

[8]Robards K., Prenzler P.D., Tucker G., Swatsitang P., Glover W., 1999. Phenolic compounds and their role in oxidative processes in fruits. Food Chem. 66, 401-436.

[9]Velázquez-Nuñez MJ, Avila-Sosa R, Palou E, López-Malo A. 2013. Antifungal activity of orange (*Citrus sinensis* var.Valencia) peel essential oil applied by direct addition orvapor contact. Food Control.31:1-4

[10] Wolfe K, Wu X, Liu RH. 2003. Antioxidant activity of Apple peels. Journal of Agricultural and Food Chemistry.51:609-614.