International Journal of Pharmaceutical Science and Research
ISSN: 2455-4685
www.pharmacyresearchjournal.com
Volume 1; Issue 1; January 2016; Page No. 37-39

Pharmacological evaluation of fruit peel

Faiza Hassan

Institute of Pharmacy, Physiology and Pharmacology University of Agriculture Faisalabad Pakistan.

Abstract
Fruits may be used as drug. Every part of fruit has medicinal/pharmacological property. Leaves, stem, fruits and fruit peels all have such chemicals which may be used in pharmacology because all of them have pharmacological active compounds. Fruit peels have very less side effects. Mango, orange, pomegranate and apple peels have pharmacologically active compounds which may be used for the treatment of various types of cancers and also as anti-inflammatory and antimicrobial agents.

Keywords: Pharmacological activity, Fruit peel, cancer, anti-inflammatory, antimicrobial agents.

Introduction

Fruits are rich source of phytochemicals which are used for prevention and treatment of many diseases. The medicines obtain from plant source are considered good because these have less undesirable effects. Each and every part of fruit is rich source of such compounds which have medicinal qualities. No part of fruit is useless. Fruit pulp, seed and peel are full of nutrients. Fruit pulp and seeds are mostly used in industry for manufacturing of different products, mostly fruit peel is discarded. It has been reported that fruit peel also have important chemicals. Fruit peels have pharmacological properties and very less toxicological effects. It has been reported that peels of fruits have higher amount of bioactive compound than peeled fruits. (Leontowicz, Gorinstein *et al*. 2003) [12].

Mangifera indica (Mango) peel

M.indica is topical fruit in Asia; it is common fruit in Pakistan. *M.indica* contain many bioactive compounds *i.e.* polyphenol, catechol, resorcinol (Kozubek and Tyman, 2005), flavenoid (Kim, Moon *et al*. 2010) [9], carotenoids, vitamin E and vitamin C (Ajila *et al*.2007).

*M.indica*peel extract has anti-inflammatory activity and this activity is due to the presence of 5-(110Z-heptadecenyl) and 5-(80Z, 110Z-heptadecadienyl)-resorcinols. These both compounds are potent inhibitor of leukotriene (5-LOX) and cyclooxygenase (COX1) (COX2) enzymes. (Knödler, Conrad *et al*. 2008)

M. indica peel has antioxidant property (Ajila *et al*.2007) and this antioxidant property is due to the free radical scavenging ability due to presence of polyphenol and flavonoid. Similarly *M. indica* peel has anti-proliferative ability. This anti-proliferative ability of *M. indica* peel is evaluated against human gastric cancer AGS cells and human cervical cancer HeLa cells and human hepato carcinoma HepG2 cells. (Kim, Moon *et al*. 2010) [9].

Erythrocytes have great risk to be targeted by free radicals due to presence of high concentration of polyunsaturated fatty acids in membrane and the oxygen transport associated with redox active hemoglobin molecule.(Sadrazadeh *et al*.1984). *M. indica* peel extract has ability of cyto-protection against H_2O_2 induced oxidative damage in normal rat erythrocytes. (Ajila and Prasada Rao 2008) [3].

*Punica granatum (*Pomegranate) peel

P. granatum peel extract has hypoglycemic activity (Nogueira and Pereira, 1984, 1986 a,b; Zofar and Singh 1990). *P. granatum* peel extract decrease the blood glucose level by regeneration of beta cells in the pancrease which in turns increase the plasma insulin level. (Khalil 2004) [8].

Radiotherapy is used for the treatment of many diseases. Radiation induced enteritis is one of the side effect of radiotherapy. Some researchers observed the radio-protective abilities of *P. granatum* peel extract on the ileum which has been damaged by irradiation. Irradiation causes decrease in glutathione and antioxidant, increases pro-inflammatory cytokines (TNFalfa. IL-1beta and IL-6), while *P. granatum* peel extract reverses these indices so *P. granatum* is radioprotectve. (Toklu, Şehİrlİ *et al*. 2009) [17].

P. granatum peel extract has gastroprotective ability (Gharzouli A 1999) *P. granatum* peel extract has antioxidant activity (Chidambara Murthy, Jayaprakasha *et al*. 2002) [4]

A research has been conducted to access the effect of *P. granatum* peel extract on the liver fibrosis, for this purpose liver fibrosis has been induced by bile duct ligation. Serum aspartate aminotransferase (AST), alanine aminotransferase (ALT) and lactate dehydrogenase (LDH) and cytokines levels are indicator for liver function and cell damage. In bile duct ligation induced liver fibrosis the level of ALT, AST, LDH and cytokines has been increased which may be decreased with the use of *P. granatum* peel extract.PPE diminishes the BDL induced liver fibrosis and improve liver structure and function.(Toklu, Sehirli *et al*. 2007) [18]

P. granatum peel extract has protective effect against prostatitis in rats, this activity is due to antioxidant property. (Kuang, He *et al*. 2009) [11]

P. granatum peel extract has high level of phenolic compounds. The peel extract was formulated as water soluble gel. Different concentration of gel was applied on wound and compared with topical antibacterial applicant, the research showed that PPE has good wound healing activity. (Chidambara Murthy, Reddy *et al*. 2004) [2]

P. granatum peel extract has polyphenol especially tannins which have antimicrobial activities (antiviral. antibacterial, antifungal activities) (Miguel MG *et al*.) Methanolic extract from pomegranate peel show antimicrobial activity against Gram +ve and Gram-ve bacteria with MIC 0.2-0.78mg/ml. The antimicrobial activity of P. granatum peel extract was tested against two Gram–ve bacteria(*E. Coli* ATTC 11775 and *Klebsiella pneumonia* ATCC 13883) and two Gram +ve bacteria(*Bacillus subtilis* ATCC 6051 and *Staphylococcus aureus* ATCC 12600) (Fawole, Makunga *et al*. 2012) [6]

P. granatum peel extract has anti hyperlipidimic effect (Cheng *et al*. 2004) and lower the TC/HDL-C ratio and serum LDL-C level. Effective in lowering serum and hepatic lipid.

P. granaum peel extract has hepatoprotective property and can be used in the treatment of fibrosis and oxidative damage. (Chidambara Murthy, Jayaprakasha *et al*. 2002) [4]

***Malus domestica* (Apple) peel**

Apple peel is rich source of antioxidants including quercetin, catechin, phloridzin and cholinergic acid. M. domestica peel also contain triterpenoid which have antiproliferative activity and anticancer activity (Reagan-Shaw, Eggert *et al*. 2010) [16].

M. domestica peelanticancerous activity has been checked on HepG (2) human liver cancer cell. (Wolfe K *et al*.2003)

Triterpenoids in *M. domestica* peel have antiproliferative activity. Oral administration of *M. domestica* peel extract shoe significant antiproliferative activity against wide range of human cancer (Ding and colleague).

It was also suggested that antiproliferative activity of *M. domestica* peel extract is mediated by upregulation of tumor suppressor protein *i.e* mammary serine protease inhibitor (maspin) this show activity by inhibition of tumor cell invasion and metastasis.

Gastric *Helicobacter pylori* is pathogen that cause several gastrointestinal disorders including duodenal ulcer, mucosa associated lymphoid tissue lymphomas and gastric carcinomas (Franco, 2008 Mobley 2001). *H. pylori* can damage the gastric mucosa by producing oxidative effect, inflammation and host cell death. (Atherton, J. C.2006)

Multiple antibiotics and proton pump inhibitor have been use to eliminate *H. pylori* infection De (Boer *et al*.2000).But due to antibiotic resistance now a days plant derived extract are preferred for eradication of many pathogen, some plant derived extract show inhibitory activity against *H. pylori* infection.(Pastene, Speisky *et al*. 2010) [4]

Apple peels polyphenolic rich extract (APPE) has urease inhibitory activity (Pastene *et al*. 2009).APPE shows inhibitory effecton the *in vitro* nproliferation of *H. pylori* and also inhibit *H. pylori* oxidative stress on neutrophils. (Pastene, Speisky *et al*. 2010) [4]

Gastrointestinal mucosa is continuously exposed to oxidants which cause oxidative damage to gastrointestinal mucosa (Parks DA 1989 Young IS, Woodside JV 2001) it is suggested that dietry polyphenols have protetive role against many gastrointestinal diseases e.g. oxidative damage. inflammatory bowel disease (Carrasco-Pozo C, Speisky H, Brunser O, Pastene E, Gotteland M 2011).

Apple peel extract is rich source of polyphenol, polyphenol is potent antioxidant and protect the gastrointestinal mucosa from oxidative damage by scavenging free radical (Kim, Moon *et al*. 2010) [9].

In one study rats fed with high cholesterol diet and supplemented with apple peel, pear peel, peeled apple and peeled pear. The result showed that apple and pear peel supplemented diet have protective effect on plasma lipid and plasma antioxidant activity. The ethanol extract of apple peel show lipid peroxidation inhibition activity due to presence of phenol and total flavonoids.(Leontowicz, Gorinstein *et al*. 2003) [12].

Citrus peel

Citrus peel extract with ethanol. Acetone and chloroform show antibacterial activity against G+ve and G-ve bacteria (Jayaprakasha, Negi *et al*. 2000) [7] Citrus peel oil show lipolytic activity (Choi 2006) [5].

Citrus peel is rich source of antioxidant and anti-inflammatory compound (Rehman, 2006, Huang and Ho, 2010)

Bok *et al*.1999 reported that citrus peel diet in rats reduced cholesterol in plasma and in liver. Citrus peel reduce cholesterol by inhibiting enzymes which are responsible for cholesterol metabolism these enzymes include 3hydroxy-3-methyl-glutary-CoA reductase and acyl CoA cholesterol O-acyltransferase.

Obesity is condition in which adipose tissue amount increases due to abnormal accumulation of fat, obesity lead to many metabolic syndromes these syndromes occur due to oxidation of accumulated fat (Furukawa *et al*. 2004) Citrus peel prevent obesity and metabolic syndrome by controlling the expression of genes related to lipid accumulation and adipogenesis in 3T3-L1 adipocytes.

Anthelmintic activity of citrus peel ethanolic extract was investigated against Ascardiagalli and it was concluded that citrus peel extract has anthelmintic property against Ascardiagalli. (Abdelqader, Qarallah *et al*. 2012) [1]

Tyrosinase inhibitors are used for suppressing unwanted hyperpigmentation in human skin. Immature calamondin peel (Chinese lime) is rich source of 3, 5-di-c-beta-glucopyranosylphloretinniringin and hesperidin. C-glycolate flavonoid which show strong tyrosinase activity (Lou, Yu *et al*. 2012) [13].

Citrus hystrix peel has high amount of flavonoids compounds (hesperdin, naringenin) (Ampasavate C, Okonogi S, Anuchapreeda S. 2010) which have the free radical scavenging ability (Jayaraman J, Namasivayam N. 2011)

Patient suffering from cancer has to be treated with chemotherapy (KrzesińskiP, *et al* .2010). Doxorubicin is anticancer drug that is use for the treatment of cancer (Duran I, *et al*. 2006 Kumar S, *et al*. 2012) Long term use of chemotherapy drugs may lead to toxicity. Doxorubicin long term use may lead to cardiomyopathy which eventually lead to congestive heart failure (Simůnek T, *et al*. 2009) Patient treated with doxorubicin also suffer liver abnormalities (Henninger C, 2012) These abnormalities may be due to free radicals which are generated by doxorubicin metabolism (Arafa HM, 2005) These free radical cause cellular damage.

Cardiotoxicity and hepatotoxicity induced by doxorubicin can be minimized by cardio protective and hepatoprotective effect of Citrus hystrix (Putri, Nagadi *et al*. 2013) [15].

Many drugs metabolized by enzyme cytochrome 4(450)3A4 CYP3A4. If there is need to increase the oral availability of CYP3A4 metabolized drugs then these drugs should be co-administered with grape fruit peel extract because grape fruit peel has CYP3A4 inhibitory capacity. The CYP3A4 inhibitory

activity of grape fruit peel is due to presence of furanocoumarin epoxybergamothin (Wangensteen, Molden *et al*. 2003) [19].

Conclusion

To improve the quality of life pharmacologists are trying to discover drugs in plants parts as these have less side effects and by using such drugs we become closer to nature. Fruit peels are usually discarded and consider as pollutant but now a day's fruit peel's importance has been realized. Fruit peel contain many pharmacologically active compounds and has potential to treat many diseases.

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