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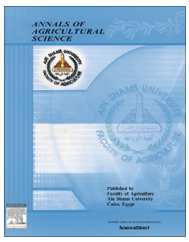

The hypolipidemic effect of *Portulaca oleracea* L. stem on hyperlipidemic Wister Albino rats

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Mucilage

Abstract *Portulaca oleracea* has been listed in the World Health Organization as one of the most used medicinal plants. *Portulaca oleracea* stems (POS) acts about 75% from weight of plant. The production of stems was the most economic between other organs. This study carried out to investigate the hypolipidemic effect of POS preparations. Three preparations of POS were tested: stem powder (POS-$_{powder}$), stem infusion (POS-$_{infusion}$) and stem 70% ethanolic extract (POS-$_{ethanolic\ 70\%}$). POS preparations contained useful components with different proportion such as polyphenolics, flavonoids, alkaloids, tannins, saponins and mucilage. The effect of POS on weight and lipid profile investigated on dietary hyperlipidemic Wister Albino rats fed on hyperlipidemic diet contained 20% fat, 1% cholesterol and 0.25% colic acid. The experimental period was 8-weeks. POS-$_{powder}$ form was supplemented at 10% in hyperlipidemic diet while POS-$_{infusion}$ and POS-$_{ethanolic\ 70\%}$ force fed by 1.0 g/kg body weight. The hyperlipidemic model described with elevated weight, feed intake, total cholesterol (TC), total lipids (TL), triglycerides (TG), low density lipoprotein cholesterol (LDL-C), very low density lipoprotein cholesterol (VLDL-C) levels and risk ratio was significantly, compared with untreated control after 4 and 8 weeks. Contrary high density lipoprotein cholesterol (HDL-C) of hyperlipidemic control was decreased significantly. POS preparations improved all obvious abnormal lipid parameters and risk ratio compared with hyperlipidemic control. The abnormalities, which was shown on liver status of hyperlipidemic rats were ameliorated by administration of POS preparations significantly. Liver histology showed significant improvement after treating hyperlipidemic rats by POS form compared with hyperlipidemic control.

Introduction

Portulaca oleracea L. (*subsp. oleracea*) is a weed spread in the Egyptian fields has been used as a nutritious vegetable for human nutrition. *P. oleracea* has been mentioned in Egyptian texts from the time of the Pharaohs (Kesden and Will, 1987). It has been listed in the World Health Organization as one of the most used medicinal plants. The taste of plant is like spinach:

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a slightly acidic and salty taste (Samy et al., 2004). In folk medicine, it has been used for remediation dysentery, boils and sores, eczema, erysipelas, checking cough, dispelling phlegm and snake and insect-bite, diuretic, febrifuge, antiseptic, antispasmodic and vermifuge (Xaing et al., 2007). Also, many pharmacological effects of *P. oleracea* were documented like anti-oxidation, anti-bacteria, anti-virus, anti-ulcerogenic, anti-inflammatory, skeletal muscle-relaxant, wound-healing and hypoxic nerve tissue protective effect (Parry et al., 1993; Rashed et al., 2003; Xie, 2002; Wang et al., 2007). The seeds or its extracts; infusion, 70% alcoholic and petroleum ether have hypolipidemic and hypoglycemic activity in hyperlipidemic rats (El-Newary et al., 2011).

P. oleracea is a good source of compounds with a good human health benefits. These compounds include omega-3 fatty acids and β-carotene, vitamins and essential amino acids and glutathione (Liu et al., 2000; Simopoulos et al., 1992). It contains phenolics and alkaloids (Spina et al., 2008; Xaing et al., 2007). Flavonoids of *P. oleracea* L., contain Kaempferol, apigenin, myricetin, quercetin and luteolin as a major components (Xuqin et al., 2005).

The stem of *P. oleracea* (POS) acts about 75% from the weight of plant. It means that, stem was the biggest organs of plant and production of POS was economic. The production of stems was reached 22–25 and 2–2.7 ton/Fadden fresh and dry weight respectively. POS was very mucilaginous (El-Newary, 2012). Total fatty acid contents in POS ranged from 0.5 to 0.9 mg/g and α-linolenic is the major fatty acid followed by linoleic acid and palmitic acid Liu et al. (2000). However, the studies on the chemical and biological evaluation of POS stems were very little.

Hyperlipidemia is a heterogeneous disorder described by an elevation on total cholesterol (TC), triglycerides (TG), very low density lipoprotein cholesterol (VLDL-C), low-density lipoprotein cholesterol (LDL-C), free fatty acids (FFA), and apolipoprotein B (apo B) levels, as well as reduced high-density lipoprotein cholesterol (HDL-C) levels. These disorders were happened as results of metabolic disorders, or dietary and lifestyle habits (Kolovou et al., 2005). Several studies reveal that an increase in HDL-C and decrease in TC, LDL-C and TG are associated with a decrease in the risk of ischemic heart diseases. Many drugs have been reported as a hypolipidemic, including bile acid, resins, statins, fibrates, niacin and cholesterol absorption inhibitors are common treatments for hyperlipidemia. However, severe side effects are associated with the use of these drug for lipid-lowering medications (Rodenburg et al., 2004). Most of the antihyperlipidemic drugs are causing significant reduction in both TC and HDL-C (Saravanakumar et al., 2010). Many natural compounds were documented as a hypolipidemic agents such as polyphenolics, flavonoids, tannins, alkaloids, phytosterol, unsaturated fatty acids and dietary fibers. Many functional foods, including flaxseed, garlic, viscous fiber, almonds, nuts and soy proteins have been examined as hypolipidemic agents (Micallef and Garga, 2009). These functional foods are effective in reducing both TC, TG and LDL-C; and have no effect on HDL-C levels. Many medicinal plants were documented as a hypolipidemic agents: decreased TC, TG, LDL-C and increased HDL-C. These plants are *Lycium barbarum* polysaccharides (Ming et al., 2009), Flaxseed lignin (Fukumitsu et al., 2008 and Fukumitsu et al., 2010), *Sesbania grandiflora* (Saravanakumar et al., 2010), *Adonis vernalis*, (Lateef et al., 2012), purslane (*P. oleracea* L.) seeds (El-Newary, 2012) saffron (Mashmoul et al., 2013) and *Cordia dichotoma* pulp (Sulieman and El-Newary, 2014).

The main target of this study was to evaluate the anthyperlipidemic and hepatoprotective effect of POS preparations against hyperlipidemic diet induced-hyperlipidemic rats. The protection effect of POS preparations was estimated by surveillance lipid profile (TL, TC, TG, LDL-C, VLDL-C and HDL-C) and liver functions (total protein, albumin, globulin, alanine aminotransferase and aspartate aminotransferase).

Material and methods

Plant material

Collection of plants

Cultivated *P. oleracea* subsp. *oleracea* (Riglah) was collected during summer 2014 from El-Sharkia Governorate, Egypt. Plants were identified by Dr. A. El-Megaly (Department of the herbarium of Flora and Phytotaxonomy Research, Horticulture Research Institute, Agriculture Research Center). The voucher specimen (No. 136) was deposited in the herbarium of (CAIM). Stems of plant were separated and air-dried at room temperature and completed drying on oven at 50 °C for 24 h.

Preparation of POS-$_{infusion}$

Grinded dried *POS* (100 g) was steeped in liter boiling water and left over night at room temperature. Next, this infusion was decanted and centrifuged. The supernatant was dried by rotary evaporator and completed dryness on oven at 50 °C. The yield was 22.50 g/100 g dry stem (Afifi et al., 2005).

Preparation of POS-$_{ethanolic\ 70\%}$

POS powder (1000 g) was exhaustively extracted by cold maceration process with petroleum ether 40:60, chloroform, ethyl acetate and ethanol 70% sequentially according to Devi and Sharma (2004). The yield of ethanol 70% was 156.32 g/kg.

Chemical composition of POS preparations

- Crude fat% of *Portulaca oleracea* stems was determined according to the methods described by A.O.A.C. (2000).
- Unsaponifable and saponifable matter of Portulaca oleracea oil were separated and identified according to method of A.O.A.C. by GLC.
- The non-saponifable matter was prepared according to A. O.A.C standard method No. 933/08.
- Fatty acid methyl esters of *Portulaca oleracea* stems oil were determined according to A.O.A.C standard method No. 969/33 (Firestone, 1990).

Phytochemical screening of POS preparations; POS-$_{10\%\ powder}$, POS-$_{infusion}$ and POS-$_{ethanolic\ 70\%}$ were performed using standard procedures, which was described by Balbaa et al. (1981). Total polyphenols were determined spectrophotometrically by Folin-Denis reagent as gallic acid according to Gorinstein et al. (2004). The total flavonoids and condensed tannins content were determined spectrophotometrically according to method of Lin and Tang (2007) and Julkunen-Titto (1985). Total saponins, total alkaloids and mucilage