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Caper the Mystique of the recent century

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ABSTRACT: Caper (*Capparis spinosa*) plant was used from a long time ago by the ancient Greeks and the romans for medicinal purposes. Capers are said to reduce flatulence and to be anti-rheumatic in effect. In ayurvedeic medicine capers are recorded as hepatic stimulants and protectors, improving liver function. Capers have reported uses for arteriosclerosis, as diuretics, kidney disinfectants, vermifuges and tonics. Infusions and decoctions from caper root bark have been traditionally used for dropsy, anemia, arthritis and gout. Capers contain considerable amounts of the anti-oxidant and bioflavonoids. Caper extracts are potential sources of novel antimicrobial compounds especially against bacterial pathogens and new research suggest a possible use of C.spinosa as a source of natural antioxidant and antimicrobial agents.

Key words: Capparis spinosa,Caper,Microbial activity,Medicinal property

INTRODUCTION

Nature has been the source of medicinal agents for thousands of years, and an impressive number of modern drugs have been isolated from natural sources, many based on their use in traditional medicin.These plant based traditional medical systems continue to play an essential role in health care , with about 80% of the world,s in habitants relying mainly on traditional medicines for their primary health care (WHO, 2002-2005).There is great promise for new drug discovery based on traditional plant uses.Also, plant may be used as food , and it is difficult to draw a line between these two groups; food may be medicine and vice versa(Pieroni,2000).There will be multipurpose benefits from the natural flora or threatened plant species (Kara et al,1996)(Ozer,2005).Capparis spinosa is one such plant established to have highly diverse economic and medicinal value in different system of medicines like in Iranian, Unian,Chinese,Ayurvedic and Greco-Arabi system of medicins.C. spinosa is well known with its common name ,caper, in different countries(Azaizeh el al,2003).It has demonstrate high adaptability to unfavorable ecological condition as a multi – faceted evaluation of products because of the potential of this plant appear to be promising (Sharif moghaddasi,2010).

Origin

There is a strong association between the caper bush and oceans and seas.*C. spinosa* is said to be native to the Mediterranean basin,but its range stretches from the Atlantic coasts of the Canary Islands and Morocco to the Black Sea to the Crimea and Armenia, and eastward to the Caspian Sea and into Iran. Capers probably originated from dry regions in west or central Asia. Known and used for millennia, capers were mentioned by Dioscorides as being a marketable product of the ancient Greeks. Capers are also mentioned by the Roman scholar, Pliny the Elder.The relationship between capers and human beings can be traced back to the stone age.Remains of *C. spinosa* were unearthed in archaeological sites as early as the lower Mesolithic(Hansen,1991).

The caper bush (*C. spinosa*) has been introduced as a specialized culture in some European countries in the last four decades. The economic importance of the caper plant led to a significant increase in both the area under cultivation and production levels during the late 1980s. The main production areas are in harsh environments found in Morocco, the south eastern Iberian Peninsula, Turkey, and the Italian islands of pantelleria and Salina. This species has developed special mechanisms in order to survive in the Mediterranean conditions, and introduction in semi-arid lands may help to prevent the disruption of the equilibrium of those fragile ecosystems (Sozzi, 2001).

Botany

Capparaceae are a medium-sized family of approximately 40–45 genera and 700–900 species, whose members present considerable diversity in habit, fruit, and floral features (Pieroni,2000) (Kara et al,1996)(Ozer,2005).*C.spinosa* L.(Capparidaceae or Capparaceae),a winter- deciduous species , is one of the few prennial shrubs that grow and flower entirely during summer.In Dioscorides'herbal, *C.spinosa* is referred to as a species distinct enough not to be confused with anything else(Raven,1990).

The shrubby plant is many-branched, with alternate leaves, thick and shiny, round to ovate in shape. The flowers are complete, sweetly fragrant, showy, with four sepals, and four white to pinkish-white petals, many

long violet-colored stamens, and a single stigma usually rising well above the stamens (Watson and Dallwitz,1992).

Nutrition Information

Caper has considerable nutritional value and the floral buds are extensively used in diet as vegetable (Ozcan,2005). The ripened fruit are rich from protein, lipid, carbohydrates and vitamins and minerals. Outside of the Mediterranean and the Caucasus mounyains, capers are not much known, although the pickled fruits of some central Asian species are used in vegetable in Afghanistan, Pakistan and North Western India(Ozcan,2005)(Fragiska,2005).

Capers are one of the plant sources high in flavonoid compounds rutin (or rutoside) and quercetin. Capers are in-fact very rich source of quercetin (180 mg/100 g) second only to tea leaf. Both these compounds are powerful anti-oxidants. Research studies suggest that quercetin has anti-bacterial, anti-carcinogenic, analgesic and anti-inflammatory properties. Furthermore, rutin strengthen capillaries and inhibits platelet clump formation in the blood vessels. Both these actions of rutin help in smooth circulation of blood in very small vessels. Rutin has found application in some in trial treatments for hemorrhoids, varicose veins and in bleeding conditions such as hemophilia. It also found to reduce LDL cholesterol levels in obese individuals the spicy buds contain healthy levels of vitamins such as vitamin A, vitamin K, niacin and riboflavin (table 1). Niacin helps lower LDL cholesterol.Minerals like calcium, iron and copper are present in them. High sodium levels are because of added granular sea salt (sodium chloride) (10).

With reference to one serving size (8.6 g of capers), rutin was 13.76 mg, isothiocyanates, recently acknowledged as anticarcinogen phytochemicals, were 42.14 micromole, total phenols were 4.19 mg of gallic acid equivalents (GAE), and the total antioxidant potential measured using the [2,2'-azinobis(3-ethylbenzothiazoline-6-sulfonic acid)] diammonium salt (ABTS) cation radical decolorization assay was 25.8 micromole of Trolox equivalents(Tesoriere et al,2007).

Table 1. Capparis spinosa, canned, Nutrient value per 100 g (Source: USDA National Nutrient data base)

Principle	Nutrient Value	Percentage of RDA	Minerals	Nutrient Value	Percentage of RDA
Energy	23 Kcal	1%	Calcium	40 mg	4%
Carbohydrates	4.89 g	4%	Copper	0.374 mg	42%
Protein	2.36 g	4%	Iron	1.67 mg	21%
Total Fat	0.86 g	3%	Magnesium	33 mg	8%
Cholesterol	0 mg	0%	Manganese	0.078 mg	3%
Dietary Fiber	3.2 g	8%	Phosphorus	0 mg	1%
Vitamins			Selenium	1.2 mcg	2%
Folates	23 mcg	6%	Zinc	0.32 mg	
Niacin	0.65 mg	4.5%	Phyto-nutrients		
Pantothenic acid	0.02 mg	0.5%	Carotene-ß	83 mcg	
Pyridoxine	0.02 mg	2%	Carotene-α	0 mcg	--
Riboflavin	0.13 mg	11%	Cryptoxanthin-ß	0 mcg	--
Thiamin	0.018mg	1.5%	Lutein-zeaxanthin	0 mcg	

Microbiological properties

In laboratory study, extracts of the aerial parts of *Capparis spinosa* exhibited antibacterial activity against Gram-positive and Gram-negative bacteria and antifungal activity (Mahasneh,2002).In another study Lactobacilli from caper fermentation are metabolically diverse, and some strains display functional properties of interest(Perez-Pulido et al,2007a).Also a collection of lactobacilli comprising species of *Lactobacillus plantarum* (43 isolates), *Lactobacillus brevis* (9 isolates) and *Lactobacillus fermentum* (6 isolates) obtained from spontaneous fermentations of capers(Perz-Pudilo et al,2005b). A collection comprising 14 isolates of *Pediococcus pentosaceus* and one *Pediococcus acidilactici* from the fermentation of caper fruits are sensitive to 11 different antimicrobials while being resistant to ciprofloxacin (MIC > or =2 mg/liter) and intrinsically resistant to vancomycin (MIC > or =16 mg/liter) and teicoplanin (MIC > or =16 mg/liter) (Perez et al., 2006). A new inhibitor of in vitro tumor cell replication, cappamensin A (1) (2H-1,4-benzoxazin-3(4H)-one, 6-methoxy-2-methyl-4-carbaldehyde), was isolated from the roots of *Capparis sikkimensis* sub sp. Compound 1 displayed significant in vitro anticancer activity against ovarian (1A9), lung (A549), ileocecal (HCT-8), breast (MCF-7), nasopharyngeal (KB), and vincristine resistant (KB-VIN) human tumor cell lines with ED(50) values <4 microgram/mL (mean GI(50) value of 15.1) (Wu et al.,2003).

During this study molecular identification from fermentations of capers revealed the presence of *Enterococcus faecium* (nine isolates), *Enterococcus faecalis* (4), *E. avium* (3) and *Enterococcus casseliflavus/flavescent s*(Perez et al., 2006).Also *Lactobacilli* from caper fermentation are metabolically diverse, and some strains display functional properties of interestPérez-Pulido et al,2007).

Methanolic extract of *C. spinosa* buds (CAP) treatment interferes with HSV-2 replication in PBMCs inhibiting the extracellular virus release up-regulating their production of IL-12, IFN-gamma and TNF-alpha. CAP may

contribute in improving immune surveillance of PBMCs toward virus infection by up-regulating expression of peculiar pro-inflammatory cytokines; it should thus be successfully employed for treatment of HSV-2 infections in immune compromised hosts(Arena et al,2008).Another study revealed that A decoction of *C.spinosa* roots, showed an interesting bacteriostatic activity on the growth of *Deinococcus radiophilus* (Boga et al., 2006|). Significant reductions in plasma triglycerides, total lipids and phospholipids concentration were noticed by supplementing the diet of 15 hyperlipidemic adults (40-60 yrs.) with teent (unripe fruit of *Capparis decidua*) for three months (Goyal and Grewal., 2003).

It is worth mentioning that lyophilized methanolic extract from flowering buds of Capparis spinosaL. (LECS) was able to counteract the harmful effects induced by IL-1beta. This protection appeared to be greater than that elicited by indomethacin, which is usually employed in joint diseases. Since LECS possess a chondroprotective effect, it might be used in the management of cartilage damage during the inflammatory processes(Panico et al,2005).Moreover aqueous extract of C.spinosa (20 mg/kg) exhibits a potent lipid lowering activity in both normal and severe hyperglycemic rats after repeated oral administration of CS aqueous extract (Eddouks et al,2005). In another study Lactobacillus plantarum (37 isolates), Lactobacillus paraplantarum (1 isolate), Lactobacillus pentosus (5 isolates), Lactobacillus brevis (9 isolates), Lactobacillus fermentum (6 isolates), Pediococcuspentosaceus (14 isolates), Pediococcusacidilactici (1 isolate), and Enterococcus faecium (2 isolates) were isolated from fermentation of capers (Pérez Pulido et al 2005 a).

The antiallergic properties of two lyophilized extracts obtained from C. spinosa flowering buds (capers) by methanol extraction, carried out at room temperature (CAP-C) or with heating at 60 degrees C (CAP-H), were investigated. These two caper extracts displayed marked antiallergic effectiveness; however, the protective effect of CAP-H was very likely due to an indirect mechanism; conversely, CAP-C is endowed with direct antihistaminic properties (Trombetta et al,2005).

Administration of C. decidua fruit extract significantly reduced serum total cholesterol (61%), LDL cholesterol (71%), triglycerides (32%) and phospholipids (25%). Similarly C. decidua shoot extract lowered serum total cholesterol (48%), LDL cholesterol (57%), triglycerides (38%) and phospholipids (36%) (Purohit et al, 2005). Also stems and flowers extracts of this plant showed insecticidal and oviposition inhibitory activities against Bruchuschinensis(Upadhyay et al, 2006).In the open field test all doses of C. decidua extract tested decreased the number of rearings, grooming, and fecal bolus. C. deciduas extract increased the percentage of animals exhibiting motor deficit in the rotarod test. C.decidua extract dose-dependently decreased the number of animals with convulsions and increased convulsion latency.C.decidua extract decreased the duration of tonic hind leg extension in maximal electroshock-induced seizures (Goyal et al,2009).Another researchers proved that these extracts are prominently rich in phenolic and glucosinates, and they showed potent antidiabetic and anti-hemolytic activity (Zia-Ul-Haq et al,2011).

In the similar study,the ethanol and water extracts of Capparis zeylanica leaves showed dose-dependent and significant increases in pain threshold in tail-immersion test (Ghule et al,2006).Besides C. zeylanica extracts prevented Myelosuppression in mice treated with Cyclophosphamide drug (Ghule et al ,2006).

During present literature review Ethanolic extract from C.spinosa could significantly inhibit the proliferation of fibroblast and reduced the expression of alpha2 (I) collagen mRNA and type I collagen protein in progressive systemic sclerosis in a dose-and time-dependent manner. ECS did not affect the proliferation of fibroblast and expression of type I collagen mRNA and protein in normal human. ECS could counteract the harmful effects on fibroblast by H2O2 (Cao et al,2008).A dimeric 62-kDa lectin exhibiting a novel N-terminal amino acid sequence was purified from caper (Capparis spinosa) seeds. The lectin potently inhibited HIV-1 reverse transcriptase with an IC50 of 0.28 microM and proliferation of both hepatoma HepG2 and breast cancer MCF-7 cells with an IC50 of approx. 2 microM. It induced apoptosis in HepG2 and MCF-7 cells. It manifested a weaker mitogenic activity on mouse splenocytes than ConA (concanavalin A). It inhibited Mycelial growth in Valsamali with an IC50 of 18 microM(Lam et al,2009).

The Capparis masaikai extract had a long-lasting moistening effect on both the tongue dorsum and buccal mucosa for up to 60 min. The weakly bitter sweet taste of the extract was perceived stronger than the other taste elements (Kitada et al,2008).

Medicinal Usage

A commercially available preparation, Liv-52® (Himalayan Co. India) containing *C.spinosa* in combination with other constituents, contains iron, which may have an additive effect when taken with iron-containing drugs leading to iron overload.

C.spinosa is one of several ingredients in a combination drug, Liv-52® (Himalayan Co. India), associated with improved liver cirrhosis outcomes in human clinical study and thus may affect hepatic assays. Based on clinical study, capers may have diuretic effects; patients taking the combination product Liv-52®, containing C.*spinosa*, showed significant reductions in ascites. *C.spinosa* may have immunomodulating effects(Huseini et al,2005).

Chemical constituents

The leaf oil was composed of isothiocyanates, n-alkanes, terpenoids, a phenyl propanoid, an aldehyde and a fatty acid. The main components of this oil were thymol (36.4%). Isopropyl isothiocyanate (11%), 2-hexenol (10.2%) and butyl isothiocyanate (6.3%) was reported. The volatile oils of the ripe fruit and the root were composed mainly of the methyl isothiocyanate, isopropyl isothiocyanate and sec-butyl isothiocyanates was reported (Ahmed et al,1972).Also the leaves of *C. spinosa* have kaempferal, quercetin, isorhamnetin and their O-methyl derivative, thomnocitirin, rhamnetin andrhamnozin (Juan and Martinez,1998). Another researchers revealed that the leaf oil composes of N-alkanes, phenyl propanoid, thymol (24.4%), isopropyl isothiocyanates (11%), 2-hexenal (13.2%), butyl isothiocyanate (6.3%), chlorophyll, proline (amino acid) and starch contents were reported(Afsharypuor et al,1998).They proved that the methanolic extract of the aerial parts of *C. spinosa* yielded the new flavonoid and quercetin such as 3-O-(6"'-α-L-rhamnosyl-6"O-β-D-glucosyl)-β-D-glucoside, rutin, quercetin-3-O-glucoside and quercetin-3-O-glucoside-7-Orhamnoside were(Afsharypuor et al,1998).

The p-methoxy benzoic acid isolated from the methanolic soluble fraction of the aqueous extract of *C.spinosa* was reported (Callis et al., 1999).It was found to possess significant antihepatotoxic activity against carbontetrachloride and paracetamol induced hepatotoxicity in vivo and thioacetamide and galactosamine induced hepatotoxicity in isolated rat hepatocytes, using in vitro technique (Gadgoli and Mishra,1999). Another study proved that New spermidine alkaloids such as capparispine, capparispine-26-O-β-d-glucoside and cabadicine-26-O-β-d-glucoside hydrochloride was reported from the roots of C.*spinosa*(Xiao et al,2008). aldehydes (22.2%) and esters (21%) are the most abundant chemical classes, sesquiterpenes and ten monoterpenes were identified for the first time; among sulphur compounds (8.42%), methyl-isothiocyanate was the major one, followed by benzyl isothiocyanate was reported. The application of this solvent free extraction technique combined with the GC/MS analysis, showed its potential as a simple routine method for analyzing food flavor(Romeo et al ,2007).The dominating fatty acid of both species *C.spinosa* and *C.ovata* was linoleic acid.Oleic acid and its isomer vaccenic acid,were both found in the seed oils. The seed oils of both species were rich in tocopherols.The seed oils showed remarkably high contents ofΔ^5-avenasterol(Matthaus and Ozcan,2005).

Two new (6*S*)-hydroxy-3-oxo-α-ionolglucosides, together with corchoionoside C ((6*S*,9*S*)-roseoside) and a prenylglucoside, were isolated from mature fruits of *C.spinosa*.The ^{13}C-resonance of C-9 was found to be of particular diagnostic value in assigning the absolute configuration at that center in ionol glycosides(Calis et al,1999).The known compounds cappariloside A and stachydrin,an adenosine nucleoside, and for the first time from plants of the *Capparidaceae* family the known compounds hypoxanthine and uracil were isolated from *C. spinosa* (*Capparidaceae*) fruit(Aisa et al,2011).

In addition to rutin, quercetin 3-O-glucoside and quercetin 3-O-glucoside-7-O-rhamnoside, the methanolic extract of the aerial parts of C.spinosa yielded the new flavonoid quercetin 3-O-[6‴-α-L-rhamnosyl-6″-β-D-glucosyl]-β-D-glucoside(Sharaf et al,2000).More researches about capers proved that principal form of tocopherol detected in leaves is alpha-tocopherol. In buds and flowers, there were both alpha and gamma-tocopherols.The combined content of pro-vitamin A and vitamin E in capers encourages researchers to more explore and find developments for this plant(Tlili et al,2009).

CONCLUSION

C.spinosa is an important species in our natural surrounding and economy because of high nutrition flowers and buds,high adaptation capability and medicinal efficiency. All these features emphasise the fact that this species can be a promising species in recent century.

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